ACUTE MECHANICAL INTESTINAL OBSTRUCTION.

A THESIS

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BY

ERNEST WELLS GRAHAME.

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I N D E X.

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ACUTE MECHANICAL INTESTINAL OBSTRUCTION.

INTRODUCTION.

By intestinal obstruction is meant a prevention of the passage of bowel contents by blockage of its lumen or by paralysis of its wall. In the cases under observation, only those which were due to direct mechanical obstruction, either from causes within the bowel lumen or from causes pressing on the bowel from outside were considered. Thus, the condition of paralytic ileus was not considered except as a complication after operation for the relief of mechanical obstruction. Obstructive appendicitis, also, was not included as the appendix does not interfere with the passage of faecal material along the bowel, excepting that it may do so by adhesions, or by paralytic ileus following on acute appendicitis.

The author's interest in acute intestinal obstruction was first aroused by the fact that cases were often difficult to diagnose, especially as to the exact site of the obstruction. This caused unnecessary incisions to be made at the time of operation with consequent excess damage to tissues and delay in completing the operation. It also caused operative proceedings to be done which seemed very haphazard. Each of these proceedures increased the risk to the patient, sometimes out of all proportion to the patient's condition before the operation. Not only so, but patients at all times of life, and irrespective of other disease,

may be affected by intestinal obstruction, so that patients with an otherwise good expectation of life may succumb to this fatality.

The death rate is very high. An American report of 343 cases of intestinal obstruction in 1929 places the rate at 60·9%, and another series of 505 cases in U.S.A. in 1934 shows a mortality of 40·6%. (1). In this country, the figures of 6,892 cases from 21 of the largest hospitals showed a 26·2% mortality during the years 1925 - 1930 and, excluding the cases of external hernia, 38·8% died. (2).

In order to study the subject in detail, all the cases of intestinal obstruction admitted to CROYDON GENERAL HOSPITAL during the six years 1931 - 1936 and to the ROYAL SUSSEX COUNTY HOSPITAL, BRIGHTON, during the five years 1932 - 1936 were examined. They amounted to 361 cases. The majority of the patients during the year 1931 were operated on by the author, and all were under his care. A further series of cases at the Royal Sussex County Hospital, Brighton, admitted during 1938, was also investigated.

In the present thesis the author proposes to show that the improved results in the later series of cases are due to the improved methods in diagnosis and treatment which are now in vogue.

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SECTION II.

CAUSATION.

Mechanical obstruction of the bowel may be due to:-

(1) Conditions inside the intestine.

- (a) Foreign bodies.
- (b) Congenital septa.

(2) Conditions of the wall of the intestine.

- (a) Carcinoma.
- (b) Tuberculous stricture.
- (c) Intussusception.
- (d) Volvulus.

(3) Conditions outside the intestine.

- (a) Herniae.
- (b) Adhesions.
  - (1) Tubercular.
  - (2) Carcinomatous.
  - (3) Inflammatory.
  - (4) Post-operative.
- (c) Bands.

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(1) Conditions inside the intestine are usually foreign bodies. Although faeces may remain in the bowel for long periods, and the patient does not defaecate, symptoms of acute obstruction do not develop.

(a) Foreign bodies are mostly gall-stones which have ulcerated their way from the gall-bladder into the small intestine. They generally become impacted near the lower end of the ileum. Food products,

also, may be a cause of obstruction, especially if they contain much vegetable material. (3). One case in the first series was produced by large quantities of cocoanut which had blocked the lumen of the bowel. Round worms are a fairly common cause in some parts of the world. (4). Swallowed objects are not a cause of obstruction in the intestine. If they are large enough to pass through the pylorus, they will pass through the bowel.

(b) Congenital septa may cause obstruction either at the upper end of the small intestine (5) or due to the persistence of the cloacal membrane immediately above the anus. (6).

(2) Conditions of the intestinal wall.

(a) Carcinoma of the large bowel is the cause of most cases of large bowel obstruction, but carcinoma of the small intestine is rare. Figures in the first series were as follows:-

Total cases	361
Small bowel obstruction	252
Large bowel obstruction	109

There was 1 case of carcinoma of the small intestine, ·4% of all small bowel obstructions, but no less than 82 cases of carcinoma of the large intestine, forming 75% of the cases of large bowel obstruction.

The peculiar feature of carcinoma of the intestine is that it either encircles the bowel forming an annular constriction, or it forms polypoidal growths projecting into the lumen. It may do both. The result is that obstruction eventually follows.

(b) Tuberculous stricture is found in the lower part of the ileum. It is important to realise that there may be more than one stricture although there is one definite obstructing point.

(c) Intussusception is more common at the ileo-caecal valve than any other site. In other positions there is usually a local predisposing cause such as a Meckel's diverticulum or intestinal polyp.

(d) Volvulus may occur in either the large or small bowel. In the present series 17 were in the small intestine and 6 were in the sigmoid flexure. The factor determining volvulus is a loop of intestine fixed to a small base. This is the natural state of affairs in the sigmoid, where 1 - 2 feet of bowel is attached to a mesentery only a few inches long at its base. In the small intestine one finds that a length of bowel is adherent at two points close together, but not necessarily strangulated. This forms a loop which, when distended, may become twisted.

Volvulus of the small intestine is, therefore, usually associated with some old adhesion, but obstruction by adhesion and volvulus may occur together.

(3) Conditions outside the intestine causing obstruction are nearly always associated with small bowel obstruction.

(a) Herniae may be either external, such as inguinal, femoral, umbilical and ventral, or they may be internal. The latter are rare and may be found in the vicinity of the duodeno-jejunal junction, the ileo-caecal region, the sigmoid region, the foramen of Winslow, through the diaphragm or through an aperture in the mesentery. (7).

(b) Adhesions may arise from various conditions. Tuberculous bowel or glands, carcinomatous bowel or glands and sites of old inflammation may give rise to adhesions which are difficult to diagnose. Post-operative adhesions, either to the abdominal wall, around old drainage tube sites or to sites of previous appendix, ovarian or uterine stumps are very common and are much more readily diagnosed.

(c) Congenital bands are found in the region of the ascending colon and the sigmoid. These adhesions and bands may cause simple obstruction by blocking the lumen of the gut in one place or they may block the bowel in two places forming a loop obstruction. The importance of this is that the loop may be completely damaged and gangrene follows quickly.

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SECTION III.

THE PATHOLOGICAL PROCESS.

Whatever the cause of the obstruction, all cases exhibit similar features. Faecal material is unable to pass along the bowel. There is distension of the gut proximal to the obstruction. Flatus also collects and, owing to the increasing amount of decomposition, quickly increases the distension.

Vomiting appears, reflex in origin. If there be much bowel involved, as in large loop obstruction, vomiting is an early feature in the course of events. It also comes on sooner the higher up the bowel is the site of obstruction. At first, stomach contents are regurgitated. Later there may be loss of tone in the muscle wall of the stomach which, not only dilates but allows the pyloric sphincter to dilate. High intestinal contents may then be added to the stomach secretion and, if the bowel contents have had time to decompose, there will be a faecal odour. It is very doubtful if faeces are ever regurgitated.

The patient loses large quantities of fluid from the body, and, as it is thrcugh the stomach wall, it contains hydrochloric acid. Thus there is dehydration and loss of chlorides in the body. Often there is sweating and this also may cause loss of chloride, similar to that of heat cramps. This means a more concentrated blood, increased erythrocyte and leucocyte counts and haemoglobin rises. The viscosity of the blood increases, sedimentation rate time is prolonged and the total blood volume reduced. (8). The carbon dioxide combining power of the blood is also increased. In the early case, however, where there is no

dehydration, the leucocyte count is normal unless there be inflammation or strangulation. All cases do not show hypochloraemia but this is influenced by the duration and severity of the vomiting. It would seem that the loss of chlorides is made good by the tissues before the chloride level in the blood falls. (9).

Owing to the loss of chlorides, the body attempts to maintain its chloride level by retention of the chlorides from the urine. Normally hydrochloric acid in the gastric juice reacts with sodium bicarbonate in the intestinal juices to form sodium chloride, and this is taken back into the blood to keep up the chloride content. If hydrochloric acid is lost, there tends to be too much bicarbonate in the blood, giving rise to alkalosis. Sodium chloride itself may be lost in the vomit. When the kidneys do not excrete chloride, they are unable to regulate the osmotic pressure of the blood in the usual way. They try to do so by not excreting as much non-protein nitrogen as normally. Thus the blood urea rises. (10). This is probably the only constant bio-chemical change present. (9).

As the blood becomes more concentrated, there is also a rise in the blood potassium to levels which are definitely toxic. Vomiting may be a means of getting rid of the excess potassium as it is secreted into the gastric lumen. The density of the blood and the potassium increase run a parallel course in most instances. (11). The administration of chloride may be a definite factor in the prevention of potassium poisoning. (12).

These chemical changes are very important and probably account for most of the signs of toxaemia in patients, especially when there is no gangrene of the bowel or infection of the peritoneum. In gangrene, the sodden condition of the bowel allows the ready passage of bacteria and peritonitis quickly sets in. In this connection, Haerem and others have not been able to prove that the toxaemia of intestinal obstruction is due to the specific toxin of the Bacillus Welchii, although that organism passes through devitalised bowel wall. (13).

Blood pressure is usually low, especially in long standing cases, due to the lowered blood volume. It has been shown that the contents of a gangrenous loop lower the blood pressure whereas the contents of a pink loop do not. The depressor substance is found in the mesenteric veins and in the urine. If venous obstruction is suddenly relieved, as in the operation for strangulated loop, the depressor substance may be thrown into the circulation in large quantities. The result is that, although intestinal obstruction be relieved, there may be an increased fall in the blood pressure. (14).

Aird and Henderson collected the transudate from strangulated loops and found it to be extremely toxic, but absorption was apparently through the peritoneum for, by keeping the loop and transudate in a rubber bag, they were able to keep the animal alive. They found two distinct substances, one probably bacterial and the other histamine,

and that the histamine content increased steadily during the first 24 hours. They also distended the bowel by gas in order to produce obstruction and, on sudden release of the distension after 6 hours, there was a fall in the blood pressure. They decided that gradual release of internal pressure was as important in intestinal strangulation as it was in prostatic distension of the urinary bladder. (15). Maycock decided that histamine played little or no part in causing death in strangulation but that loss of circulating blood volume might play a part in some cases, especially in large loop strangulations. (16).

The temperature is not raised nor is the pulse rate increased in the majority of cases. If the temperature be raised it is usually a sign of commencing peritonitis. The temperature is often lowered as a result of shock and this is well seen in cases with an extensive gangrenous loop such as volvulus. It is due to interference with the blood and nerve supply of the bowel. The pulse rate in these cases is also increased as a result of shock.

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SECTION IV.

SIGNS AND SYMPTOMS.

The signs and symptoms of acute mechanical intestinal obstruction vary according to the causation of the obstruction. Certain signs, however, are to be found in most types. These will be dealt with first and the variations noted afterwards.

GENERAL SYMPTOMS:-

Pain. The symptoms are very like those of a case of ordinary intestinal colic, but diarrhoea does not follow. In its place there is obstinate constipation and flatus is not passed. The patient is seized with colicky abdominal pain, due to the attempts of the bowel to force intestinal contents beyond the obstructing point, and referred in most cases to the umbilical region, but may be referred to a definite quadrant of the abdomen. This is best seen in massive loop obstructions as in volvulus. It may be mild or most excruciating and this is also very suggestive of massive loop obstruction. In these forms the pain has a very sudden onset, probably due to the completeness of the obstruction and the amount of circulatory and nerve disturbance. (17).

Vomiting. Nausea is present but vomiting is not always an early feature. The higher up the bowel the site of the obstruction, the sooner does vomiting set in. Thus early and persistent vomiting is a bad omen. The vomit which is at first expelled intermittently in large amounts and with force, eventually is regurgitated almost continuously in small amounts with little effort. This is often noticeable,

as the stains on the patient's chin and bed clothes indicate that vomiting has been in progress for some time. It should also be noted that the patient will often vomit when he is given even plain water. The vomit consists of stomach contents at first. Later high intestinal contents are added and may be green due to the admixture of bile or brown when there is no bile or when digestion has proceeded a stage further. If the food has lain in the intestine for a long time, there may be a faecal smell, but faeces themselves are not vomited. (18). Even in cases of obstruction of the rectum which have been ill for over a week, the large bowel seems to accommodate all the faecal material and very little if any material is passed backwards through the ileo-caecal valve. (19), (20). Eventually ulceration in the caecum takes place and the bowel burst at that point into the general cavity of the abdomen.

Constipation. Although there is complete obstruction of the bowel, flatus and faeces may be passed either naturally or with the aid of an enema after stoppage has set in. This is because the rectum and lower colon is laden and the blockage is higher up. If two enemata fail to produce an action when they have been given at hour intervals, it is almost certain that obstruction is present if the patient is complaining of colicky pain and sickness. (21).

Urine. As the vomiting increases, the urine becomes scantier and more concentrated. Owing to their loss in the vomit, the chlorides are withheld from the urine.

INSPECTION.

Facies. The patient often looks well. This is often the case in the external herniae and in carcinomatous obstruction of the large bowel. He may be slightly flushed if he has a rise of temperature, but paleness and an appearance of illness are associated with intussusception or large loop strangulations. If the vomiting is of long standing, the skin is dry owing to the dehydration.

Tongue. The tongue is moist at first but becomes dry owing to the loss of fluid in the vomit. Later it becomes brown and cracked, and sordes collect in the mouth.

Distension of the abdomen is not always present at first. Later there is bulging in the centre of the abdomen in small bowel obstruction and bulging in the flanks in large bowel obstruction. In the former type, the higher up the bowel the lesion, the less distension there will be. In the latter type, the distension always tends to be greatest in the caecum so that one may think that one is dealing with an obstruction at the hepatic flexure when the site is in the descending colon. In the later stages of large bowel obstruction, the whole abdomen becomes distended. Distension confined to one quadrant is suggestive of large loop obstruction. Always inspect all the hernial orifices.

Peristalsis is very rarely obvious. It is usually only present in thin patients who have an acute obstruction added to a previously existing chronic obstruction such as adhesions.

Palpation.

Distension. It may be possible to have a sensation of fulness of the abdomen on palpation before it is obvious to the eye. Distension localised to one area is suggestive of loop obstruction.

Tenderness is present only when there is much distension or when peritonitis sets in. It is an early sign in strangulated external herniae because of this.

Rigidity is not present unless peritonitis has set in, and for the same reason rebound tenderness is also absent.

Percussion. Fluid is not usually present except in certain carcinomatous cases but tympanites is usually present in small bowel obstruction at an early stage, and is most noticeable in loop obstructions.

Auscultation. Borborygmi may be heard all over the normal abdomen but in obstruction the sound is associated with the colicky pains. It has been pointed out that the increase in the borborygmi does not come at the height of the pain in other forms of abdominal colic but does so in intestinal obstruction. This is one of the most important early signs and exists long before any other physical signs are present. (1), (17), (20), (22), (23).

Pulse is normal in the early stages except when there is much shock as in massive loop obstructions or in cases of early peritonitis. In both types the rate is increased.

Temperature is also normal in the vast majority of cases. It is raised slightly in patients who have developed peritonitis, but it is lowered in cases associated with much shock.

Blood pressure is normal in the early case, but in those who have been ill for several days or who are suffering from much shock, it is lowered. (24).

SPECIAL SIGNS AND SYMPTOMS.

(1) Conditions inside the intestine.

(a) Foreign body. There may be a history of the ingestion of quantities of vegetable material or of previous gall stone colic. In the former the obstructing mass may be palpable.

(b) Congenital septa. This is essentially an obstruction of the babe within a few days of its birth.

(2) Conditions of the wall of the intestine.

(a) Carcinoma. The patient is nearly always over 50 years of age. It is usual to obtain a history of loss of weight, increasing constipation, perhaps alternating with diarrhoea and blood or mucous in the motions. He shows some degree of cachexia owing to continued loss of blood from the growth and from secondary infection.

The examining finger per rectum will detect a growth in the rectum and ballooning of the bowel there. Higher up one must rely on the sigmoidoscope for carcinoma of the sigmoid and one may be able to palpate tumours of the ascending, transverse and descending colons, but at the hepatic and splenic flexures or where there is much distension this is impossible. One may be able to palpate a

distended ascending and transverse colon and not find the descending colon enlarged. The diagnosis would then suggest an obstruction near the splenic flexure.

(b) Tuberculous stricture is commonest in boys and adolescents but may occur at any age. It is usually diagnosed by ruling out other possible causes of obstruction. It often causes large loop strangulations and so collapse is severe for the short time that the obstruction has been in progress. The pain, too, is often referred to the right iliac fossa in these cases.

(c) Intussusception is usually a disease of the first 2 years of life and occurs with almost equal frequency between the sexes. The child is nearly always a healthy child and the paleness of the child is out of all proportion to the rest of its physical development. The onset is acute and the cry lusty, unlike that of gastro-enteritis. (25). When the pain starts the child passes a normal motion. It may pass more motions for a time and these show blood and mucous. If the finger be passed into the rectum and withdrawn, it is covered in this "red currant jelly". With the colic, the child cries but lies quietly during the less painful periods. It lies, even during these less painful periods, with its legs drawn up.

It rarely shows previously the green motions of enteritis, nor is it the weakly dehydrated child associated with this condition. On examining the abdomen an "emptiness" may be discerned in the right iliac fossa and a sausage shaped tumour palpated usually across the upper abdomen or in the region of the descending colon. In order to aid the examination, the child may be held face downwards and with the body flexed over the examining hand. The procedure is often difficult, but if there be any doubt, it is much wiser to administer an anaesthetic and be prepared to operate straightway.

(d) Volvulus may occur at any age and in either sex. The noticeable features are the collapse and the intense pain which the patient refers to the region of the trouble, and which is due to the massive loop obstruction. The patient is often found writhing in bed and he volunteers the statement that he has never had such a severe pain before. There is usually marked tympanites over the site of the volvulus as the loop distends at an alarming rate.

(3) Conditions outside the intestine.

(a) Herniae. The external herniae show the lowest death rate of all forms of intestinal obstruction with the exception of intussusception. This is because it is the most easily diagnosed, but femoral hernia has a 50% greater mortality because it is not so readily

diagnosed as is inguinal hernia. The symptoms and sexes usually differ in the two conditions. The male suffers from strangulated inguinal hernia and complains that a lump appeared in his groin and he could not get it back. He usually vomits at the onset, as the condition is that of a loop obstruction but on a small scale. Another group of males complain that they were seized with pain in a previously existing hernia and they could not reduce it although they had been able to do so previously. In both groups it is obvious to the patient that there is something wrong and they are often in hospital within a few hours of the onset of the illness.

The female suffers from strangulated femoral hernia and, although she may complain of pain in a previously existing hernia, it is more customary to find that she complains of pain in the lower abdomen before she complains of pain in the femoral region. Very often the hernia is missed until an anaesthetic is given. This is because the hernia is of the Richter type and only a small portion of bowel wall is in the hernial sac. Vomiting is an early feature because of the loop obstruction and the fact that small intestine is involved.

In umbilical and ventral hernia the pain is referred to the site of the hernia and the diagnosis is usually easy.

(b) Adhesions. With the exception of post-operative adhesions, obstruction under this heading does not present any peculiar features. They are more often in the right lower abdomen but may be anywhere. The general symptoms associated with a previous scar will guide in the post-operative group. It is usually impossible to differentiate between cases due to tuberculous and those due to carcinomatous glands, until laparotomy has been performed. It is rare to obtain a history of previous abdominal inflammation in the inflammatory adhesion group unless there has been a definite attack of acute appendicitis which has been allowed to settle.

(c) Bands of congenital origin are nearly always found in the right iliac fossa, but as tubercular bands are also found in that region, it is usually impossible to differentiate between them. Certainly, if one sees a child, a few hours ill, showing much shock and collapse and colicky pains in the right iliac fossa, the diagnosis is in favour of adhesions from tubercular glands as they produce larger loop obstructions.

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SECTION V.

DIFFERENTIAL DIAGNOSIS.

As there are so many types and causes of intestinal obstruction, so there are many pathological conditions which may be mistaken for obstruction. Some conditions are more likely to be confused than others, some are almost confined to age groups and some are to be found in one sex only. It would be best to deal with conditions likely to simulate strangulated inguinal and femoral herniae because they form more than $\frac{1}{3}$ of all cases of obstruction.

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1. Conditions resembling strangulated external herniae.
   - (a) Acute adenitis.
   - (b) Torsion of the testis.
   - (c) Psoas abscess.
   - (d) Saphenous varix.
   - (e) Haematocele.

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(a) Acute adenitis may resemble either inguinal or femoral hernia, but the onset is not sudden, nor is there any suggestion of nausea. The patient does not complain of colicky pain in the abdomen and his temperature is usually high - over 100°. On examination, it is possible to differentiate the openings of the canals, a procedure which cannot be done in cases of strangulated hernia.

(b) Torsion of the testis occurs in boys soon after puberty and the patient gives a history of a strain when the pain developed. He lies on the affected side with his trunk flexed and his legs drawn up. He suffers from mild shock and the testicle is tender. The inguinal canal can be defined.

(c) Psoas abscess may resemble femoral hernia. It occurs between the ages of 10 - 25. The patient looks ill from his general tubercular state. He lies in bed with his thigh flexed. The swelling is much more diffuse than a femoral hernia and can also be palpated above the inguinal ligament.

(d) Saphenous varix should not be confounded with hernia, even if the vein is the seat of phlebitis. The inflammatory condition of the veins is not confined to the region of the femoral opening.

(e) Haematocele may be due to injury or to tumour of the testis. There may be much pain and swelling but the inguinal ring is free, apart from the history of injury or the finding of a tumour.

2. Conditions simulating abdominal forms of obstruction.

		AGES.			
		- 10	10-25	25-50	50
1.	Constipation.				
2.	Colic.				
3.	Enteritis.				
4.	Acute appendicitis.				
5.	Peritonitis.				
6.	Pyelitis.				
7.	Hirschsprung's disease.				
8.	Diaphragmatic pleurisy.				
9.	Perforations of ulcers.				
10.	Acute regional ileitis.				
11.	Acute Meckel's diverticulitis.				
12.	Ruptured ectopic pregnancy.				
13.	Pyosalpingitis.				
14.	Renal colic.				
15.	Twisted nephroptosis.				
16.	Twisted ovary.				
17.	Haemorrhage into ovarian cyst.				
18.	Actinomycosis.				
19.	Gall stone colic.				
20.	Acute pancreatitis.				
21.	Acute sigmoidal diverticulitis.				
22.	Ascites.				
23.	Tabetic crisis.				

2. Conditions simulating abdominal forms of obstruction.

Constipation is not an acute illness. Unfortunately, bands may be the cause of chronic obstruction, and, particularly if too much vegetable material has been eaten quickly, an acute obstruction may set in. In those cases it is better to give 2 enemata at hourly intervals and to await results. If the patient has not decidedly improved by that time, it is safer to operate. (21). Simple band obstruction may usually wait 2 - 3 hours before operation without the patient becoming much worse in that time. Increasing sickness is not a feature of constipation nor are loud borborygmi.

Colic. Simple intestinal colic causes intermittent pains and sickness but the bowels are open and, if diarrhoea has not already set in, an enema will soon produce it. The warm hand on the patient's abdomen is a great comfort and gentle massage for at least 5 minutes will get rid of any rigidity, which is not a true rigidity like peritonitis, but a temporary boarding. (26). There is no rebound tenderness. Finally, the patient will admit to the hurried ingestion of vegetable foodstuff. There is the possibility of the colic being due to lead poisoning, but the fact that the patient is a painter or lead worker and the tell-tale blue line on the gums should make the diagnosis certain.

Enteritis is mistaken for intussusception or vice versa more frequently than any other form of obstruction. The condition does not develop acutely and the child is usually a weakly one. It is irritable and the cry is not the lusty one of a child suffering from intussusception. (25). Vomiting is persistant and the stools green in enteritis.

Acute appendicitis should not be mistaken for obstruction. The pain usually commences around the umbilicus before shifting to the right iliac fossa. Sickness is present at the onset only. There is usually a small rise of temperature, maximum tenderness is over McBurney's point and rigidity is confined to the right side except in the late stages when general peritonitis sets in.

Peritonitis. The patient looks ill and is usually flushed. Temperatures are usually over 103°. Sickness may be present at the onset but does not usually continue. Pain is not colicky. The distension of the abdomen is diffuse. Tympanites is present around the umbilicus but the flanks are dull owing to the presence of fluid. The tubercular form is most common in children but the sunken features of a very thin patient with much anaemia should arouse suspicions straightway. If the patient is a female, menstruation is nearly always absent.

The pneumococcal form is associated with a lung condition and the temperature is often 105°. The gonococcal form is almost confined to young women. Apart from the flush and the temperature, one finds a purulent vaginal discharge and, on examination, the tubes are swollen and tender.

Pyelitis is found in females of any age. Temperature is usually over 103° and very little urine is passed in 24 hours. Often there is associated cystitis which will cause frequency. The patient is tender over both kidneys, anteriorly and posteriorly, but one side is more tender than the other.

Hirschsprung's disease affects children, especially boys, in the first 2 years of life. Distension is noticed from birth and, although the patient is constipated, he usually passes flatus readily and frequently. Peristalsis can often be made out and this tends to mislead one, but the chances of any other condition causing obstruction of the colon in such a young child is very remote.

Diaphragmatic pleurisy often commences with acute abdominal pain and sickness. The patient looks flushed and his temperature quickly rises to 103° or more as pneumonia nearly always develops with the pleurisy. On the other hand, most forms of obstruction show a decreasing temperature owing to increasing shock until peritonitis eventually sets in.

Perforations of gastric and duodenal ulcers may resemble acute forms of obstruction such as volvulus. The condition is found principally in males. He suffers from shock and the pain, which started in the epigastrium, spreads quickly down into the right iliac fossa and over the rest of the abdomen. It is not colicky in nature. He may be sick at the onset but not afterwards. The abdomen is rigid and rebound tenderness present, but there is no rising distension as in volvulus.
Acute regional ileitis resembles obstruction in history but the physical examination approaches that of acute appendicitis. Maximum tenderness is not over McBurney's point but nearer the umbilicus. Usually there is a history of melaena or blood in the stools. (28).
Acute diverticulitis of Meckel's diverticulum causes symptoms similar to acute appendicitis, but tenderness is nearer the umbilicus and the pain is not colicky. Sickness is usual at the onset but does not remain in evidence.
Ruptured ectopic pregnancy is obviously a disease of females during the child bearing years. The patient complains of sudden acute pain in the lower abdomen and collapses. She feels sick and giddy and looks very pale. Temperature is subnormal and pulse rate increased. She gives the history that she has missed 2 or 3 periods.

The lower abdomen is tender but there is no distension. She may be restless but she does not suffer the agony of a patient who has developed a sudden loop obstruction.

Pyosalpingitis is found in females following on a gonococcal infection. She complains of pain in the lower abdomen near the mid-line. Pain is not colicky, and she does not vomit much. Examination of the urethra and vagina shows a profuse purulent discharge, and vaginal examination reveals enlarged tubes which are very tender.

Renal colic produces a pain similar to volvulus but, whereas in the latter, pain is in one place, in renal colic it shoots through to the back or down into the groin. The abdomen shows no distension in colic but in volvulus there is local distension which increases at an alarming rate. This local distension can be palpated before it can be seen.

Twisted nephroptosis and intermittent hydronephrosis are usually found in females, particularly where there has been some upset of intra-abdominal tension by loss of fat or recent pregnancies. The patient complains of pain in the hypogastrium or iliac regions, but pain is relieved by lying down. Vomiting is not a feature.

Twisted ovary causes sudden severe pain a little above the pubis on one side or the other. The patient vomits at the start only and she has no trouble in passing flatus. On examination, one is able to detect an enlarged ovary or cyst which is very tender.

Haemorrhage into an ovarian cyst causes acute pain in the lower abdomen. The patient feels sick but vomiting is not continued. She is slightly collapsed and she may admit the presence of a swelling in her abdomen prior to the attack. On examination, a tender ovarian cyst is revealed.

Actinomycosis causes pain in the right iliac fossa because the disease, as it affects the abdomen, is to be found in the caecal region. Pain is not acute nor is there colic. As there is loss of weight, the condition may resemble cancer of the caecum and it is only on opening the abdomen that the true state of affairs is known.

Gall-stone colic occurs principally in women who are stout. The pain, which is very severe, starts in the gall bladder region and shoots to the umbilicus or to the right shoulder. There may be jaundice present if the stone has impacted in common duct. There may be sickness but there is no interference with bowel action.

Acute pancreatitis occurs in patients of the gall-bladder type and often follows an attack of acute

cholecystitis. The patient is collapsed and there is no distension of the abdomen. She complains of pain in the epigastric region and she is very tender there. Rigidity comes on early. There is no sign of colicky pain.

Acute diverticulitis of the sigmoid usually resembles "left sided appendicitis". The patient complains of generalised abdominal or peri-umbilical pain settling in the left iliac region. Temperature is slightly raised and there is no sign of shock and collapse. The pains are not colicky. Tenderness is present in the left iliac fossa and later there is rigidity but tenderness is much more severe than in carcinoma and there is no distension as in volvulus.

Ascites certainly causes distension and sickness may be present but the tympanites in the umbilical region and the extreme dulness in the flanks should give the true diagnosis straightway. Further examination will reveal an enlarged liver and a mitral lesion of the heart.

Tabetic crisis occurs principally in males as they are the chief subjects of tertiary syphilis. The pains encircle the body and are not necessarily confined to the abdomen. Bowel action is normal and there is no increasing vomiting. As suspicions are aroused, it is found that the pupils are unequal or the Argyll-Robertson phenomenon is present and that the knee-jerks are absent.

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SECTION VI.

INVESTIGATIONS.

Acute intestinal obstruction is a surgical emergency requiring urgent treatment, so much time should not be wasted in performing elaborate investigations. On the other hand, one must know that not only is the diagnosis of acute intestinal obstruction correct, but the type and the site of the obstruction in the abdomen, and the general condition of the patient. This last is the most important single factor which determines the amount which can be done for the patient. (29).

HISTORY. This is very important and, from it, one should be able to diagnose the majority of cases, because, in the early stages of most forms of obstruction, few physical signs can be found. In many patients the position of the obstruction and its probable type can also be found from the history.

Duration. How long has the patient been ill? Some forms of obstruction are much more obvious to the patient than others. These are the strangulated external herniae, intussusception and massive loop obstructions such as volvulus. As a result, he sends for medical attention much earlier than those with an insidious beginning such as acute obstruction from carcinoma of the colon which if often several days in progress before medical advice is sought and even then may be a few more days before the surgeon is called.

	NUMBER OF CASES.	SHORTEST DURATION.	LONGEST DURATION.	AVERAGE.
Intussusception	3	12 Hours	1 Day	16 Hours
Inguinal Hernia	11	4 Hours	2 Days	1·4 Days
Femoral Hernia	7	12 Hours	1 Day	14·7 Hours
Umbilical Hernia	2	1½ Days	3 Days	2·5 Days
Ventral Hernia	1	1 Day	1 Day	1 Day
Volvulus of S.I.	1	1 Day	1 Day	1 Day
Adhesions Post. Op.	6	6 Hours	3 Days	1.6 Days
Adhesions T.B.	4	1 Day	3 Days	1.5 Days
Carcinoma Coli	8	3 Days	10 Days	6 Days

Pain. Where did the pain start and has it moved? This is the most noticeable feature to the patient and is the most constant symptom whether it is very severe as in the large loop obstructions or relatively slight as in carcinoma of the colon. (17). In strangulated inguinal and umbilical herniae it is usually referred to the site of the hernia. It may be generalised and, therefore, referred to the umbilicus, or it may be referred to one quadrant of the abdomen. This latter phenomenon is probably due to the extent of the vascular and nerve involvement of the bowel, as it is most noticeable in large loop strangulations. (17). If the pain has moved, it is suggestive of peritonitis.

Sickness. How long has it been present and how much has there been? One can thus get an idea of the degree of dehydration, the possible loss of chloride and the excessive blood urea. At the commencement of the illness, stomach contents are shot out with force and in quantity. Later, small amounts are regurgitated with little effort owing to the loss of tone in the stomach. Is the vomiting "faecal" in character? The longer it has been in existence the more "faecal" it is likely to be, but it need not be "faecal" at all. If the obstruction is high up in the small intestine the vomit will consist of stomach and duodenal secretions only.

	AVERAGE DURATION OF VOMIT.	NUMBER FAECOIDAL.
Intussusception	16 Hours	-
Inguinal Hernia	1·3 Days	-
Femoral Hernia	14·7 Hours	-
Umbilical Hernia	2 Days	1
Ventral Hernia	1 Day	-
Volvulus of S.I.	1 Day	-
Adhesions - Post. Op.	1·6 Days	-
Adhesions - T.B. Etc.	1·5 Days	-
Carcinoma Coli.	4·7 Days	-

Bowel Action. When was the last movement of the bowel? Has constipation been a noticeable feature in recent months? Is there any sign of blood and mucous suggestive of carcinoma of the distal half of the large bowel or the alternating diarrhoea associated with carcinoma of the proximal half of the colon? Is there any "red currant jelly" suggestive of intussusception? It must be remembered that it is possible to have an action of the bowel after obstruction has become complete. This is particularly true of carcinoma proximal to the splenic flexure, where sickness may have commenced 2 days before there is absolute constipation.

	AVERAGE DURATION OF CASES.	AVERAGE DURATION OF CONSTIPATION.
Intussusception	16 Hours	17 Hours
Inguinal Hernia	1·4 Days	15 Hours
Femoral Hernia	14·7 Hours	1 Day
Umbilical Hernia	2·5 Days	3 Days
Ventral Hernia	1 Day	1 Day
Volvulus of S.I.	1 Day	1 Day
Adhesions Post. Op.	1·6 Days	27 Hours
Adhesions T.B. Etc.	1·5 Days	1·5 Days
Carcinoma Coli	6 Days	5·4 Days

Size of Abdomen. Has there been any increase in the size of the abdomen since the onset of the illness? If there is, it means that obstruction has been in progress for some time and that it is below the level of the duodenum, or, if distension is most noticeable in one quadrant, that a large loop obstruction is present.

Previous Operations. Has any previous abdominal operation been performed? Was a drainage tube used or did the wound become septic? Inflammatory conditions and pelvic operations are frequent causes of adhesions.

Urine. How much urine has been passed in the previous 24 hours? As dehydration increases, less urine, but more highly concentrated, is passed, and thus a guide to dehydration may be obtained.

EXAMINATION.

Facies. Is the patient flushed, suggestive of a raised temperature and, therefore, of peritonitis, or is he pale and sweating as a result of shock, or pale and cachectic from anaemia and secondary infection? Is he normal in appearance suggestive of carcinomatous obstruction in an early stage, or has he the pinched and drawn expression of a moribund peritonitis patient?

Tongue. How dry is the patient's tongue, and, therefore, his body? Is there sordes on it and in the mouth showing that dehydration has been in existence for some time? Does his breath smell of "faecal" vomit?

Temperature. Is it raised suggestive of peritonitis or is it much subnormal suggestive of shock? Both states are suggestive of loop obstructions, the former when gangrene is setting in and has allowed transudation of toxins and bacteria, the latter in the early stage of massive loop strangulation.

Pulse. Is the pulse feeble, suggestive of a lowered blood pressure and a debilitated and dehydrated patient? Is it fast, suggestive of peritonitis or shock? Most patients, however, show a normal or slightly raised pulse rate.

	AVERAGE TEMPERATURE.	AVERAGE PULSE RATE.
Intussusception	99	117
Inguinal Hernia	98	86
Femoral Hernia	98·7	84
Umbilical Hernia	98·2	107
Ventral Hernia	97	100
Volvulus of S.I.	96	80
Adhesions Post. Op.	98·1	90
Adhesions T.B. Etc.	97·8	86
Carcinoma Coli	98·2	96

Blood-Pressure. Is the blood pressure lowered much? If it is, it is a probable sign of dehydration owing to the reduced blood volume and the poor cardiac output. (30). It is just as important to make sure that the blood pressure is not high and that the cardiac and cerebral vessels the seat of degeneration which may help to cause thrombosis as the blood is thicker than normal. The patient should have ephedrin or adrenalin before receiving a spinal anaesthetic if it is low.

Abdomen. Is there much distension requiring deflation before operation? Is it central referring to small bowel obstruction, in the flanks suggestive of large bowel obstruction or is it in one quadrant like a loop obstruction? What are the conditions of the hernial openings? Are there any previous abdominal operation scars? Is peristalsis visible, suggestive of an acute illness following on a chronic obstruction? Is the abdomen soft or rigid and, if the latter, is it in one area or all over? Is tenderness present and, if so, is it confined to one area or all over the abdomen. Tenderness and rigidity mean peritonitis and an early operation, and the more widespread the inflammation, the sooner must laparotomy be carried out.

Urinary Chloride. Are chlorides absent from the urine, because they are diminished in the tissues? This is a quick easy test and should be done in all cases where vomiting has been in progress for some time. There is no sense in doing it when the illness has lasted only a few hours unless one suspects duodenal obstruction. To a small

quantity of urine in a test tube one adds a few drops of fuming nitric acid and about 1 - 2 c.cs., of silver nitrate solution. If chlorides are present they produce a white flocculation of silver chloride. If they are absent, double strength saline should be given before operation. (31).

LABORATORY TESTS.

If the patient has been ill for some days he will be dehydrated and there will be loss of chlorides. If there is no sign of peritonitis it is advisable to take samples of his blood and have them submitted to laboratory examination while he is having pre-operative medication.

Blood Chloride. How much is the blood chloride lowered? If there is much hypochloraemia, it may be necessary to give double strength saline, not only to restore the low chloride level but to prevent potassium poisoning, (11), and to maintain the osmotic pressure of the blood without the latter having to rely on retained urea for the purpose. (10). The method used by the author in the calculations in this series was Whitehorn's on plasma, which is much quicker than using whole blood. (32).

mgm. Na Cl. per 100 c.c. plasma.

	LOWEST.	HIGHEST.	AVERAGE.
Intussusception	552	602	580
Inguinal Hernia	561	610	582
Femoral Hernia	577	618	590
Umbilical Hernia	462	544	503
Ventral Hernia	-	-	602
Volvulus of S.I.	-	-	561
Adhesions Post. Op.	495	610	565
Adhesions T.B. Etc.	503	594	556
Carcinoma Coli	446	544	495

Blood Urea. How high is it? It may be so high that one wonders why the patient has not died of uraemia or has had convulsions. It is a sign of renal insufficiency due either to kidney disease, to excessive amount of urea being turned out into the blood stream or to its retention in the blood in order to keep up the osmotic pressure of the blood. If it is high, the patient should have 2 pints of glucose saline before operation in order to decrease the blood urea and minimise its poisonous effects, and he should not be given a general anaesthetic but a spinal, local or gas and oxygen.

The method used by the author is the urease Nesslerisation one which is easy and convenient and can be done with sufficient accuracy for the purpose of this investigation without using a colorimeter. (33). Results are obtained to within 10% accuracy.

mgm. Urea per 100 c.c. blood.

	LOWEST.	HIGHEST.	AVERAGE.
Intussusception	20	40	30
Inguinal Hernia	40	208	92
Femoral Hernia	40	70	53
Umbilical Hernia	180	240	210
Ventral Hernia	-	-	80
Volvulus of S.I.	-	-	100
Adhesions Post. Op.	40	120	70
Adhesions T.B. Etc.	40	130	80
Carcinoma Coli.	50	160	108

Blood Counts. Is the red cell count normal or is it high due to dehydration or low due to secondary anaemia? Is the white cell count raised as in peritonitis and dehydration? The red cell count is probably the best clinical measure of dehydration. Is the haemoglobin lowered? If it is below 70% the patient should be given a transfusion of blood before operation.

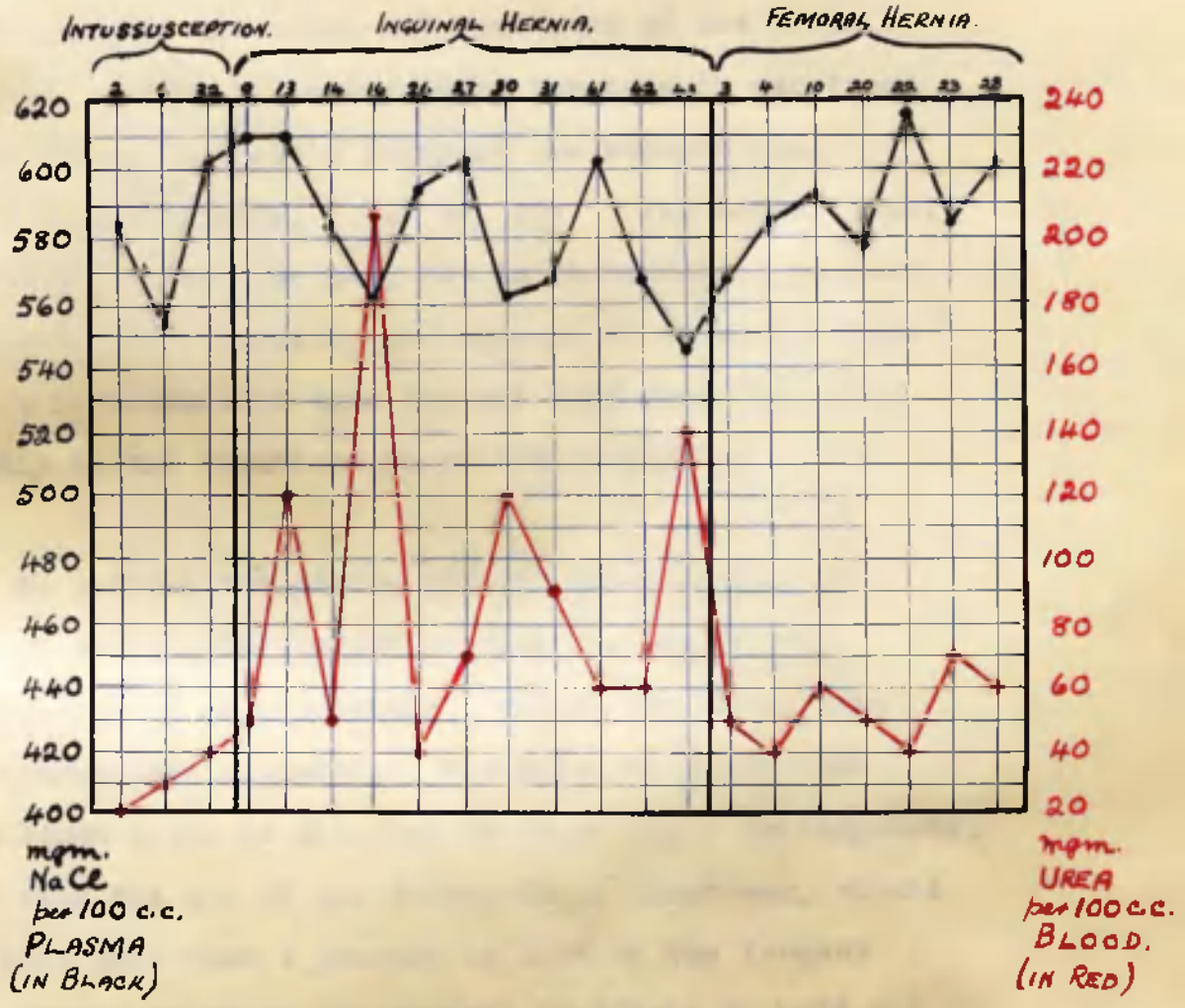


Chart showing the relationship of blood ureas and plasma chlorides in individual cases on admission to hospital. (Case numbers overhead).

X-Ray Examination. Sometimes there may be a doubt as to whether one is actually dealing with an actual obstruction of the bowel and what part of the bowel is involved. This is particularly the case in carcinoma of the colon. A plain X-ray of the abdomen will prove it immediately. (1, 34, 35). The normal small intestine contains no gas, but in obstruction, whether mechanical or otherwise, gas appears at an early stage and it is because of this feature that X-ray can help greatly in the verification of the diagnosis. (23, 36).

No preparation of the patient is required, no risk of waiting for barium to find its way to the obstruction or of completely blocking the bowel with the cement-like material. A single posterior view on a large plate is all that is required. The exposure, made with the aid of the Potter-Bucky diaphragm, should not last more than 4 seconds as that is the longest time during which an ill patient is likely to hold his breath. (37).

In small bowel obstruction it is not always possible to locate the site of the block, but it is often possible to know the relative height of the stoppage, because the

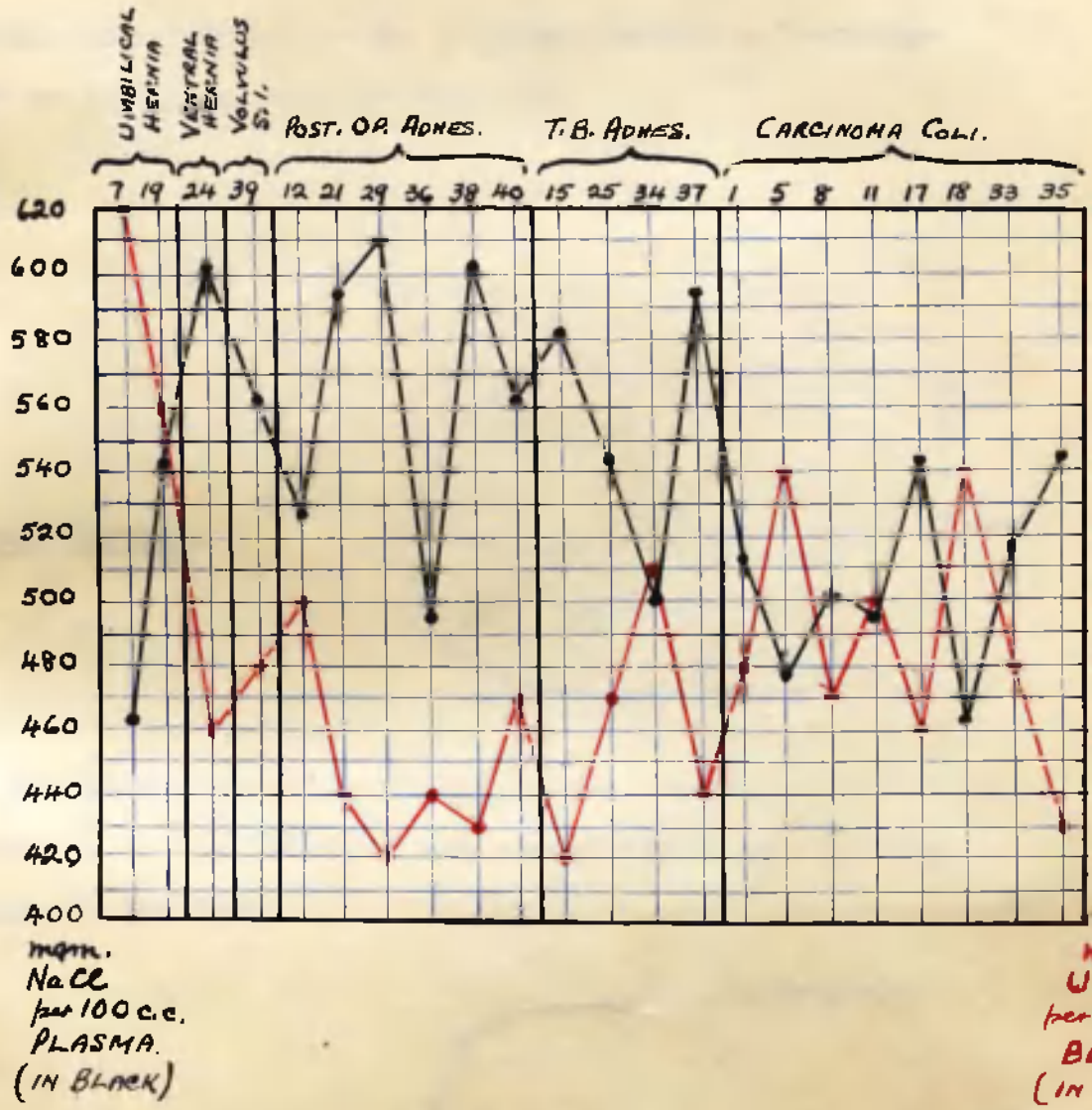
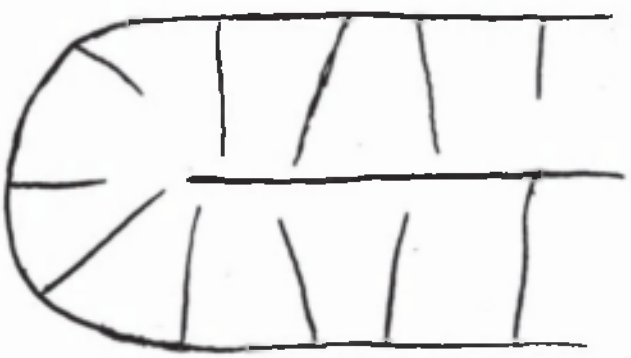


Chart showing the relationship of blood ureas and plasma chlorides in individual cases on admission to hospital. (Case numbers overhead).

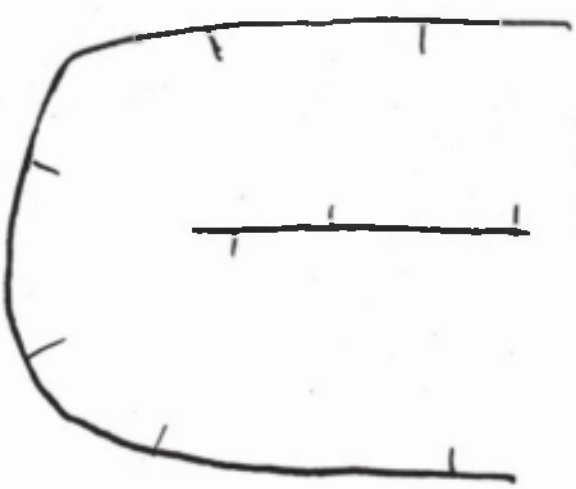
valvulae conniventes in the jejunum produce a "herring-bone" or ladder pattern on the film.

JEJUNAL PATTERN.



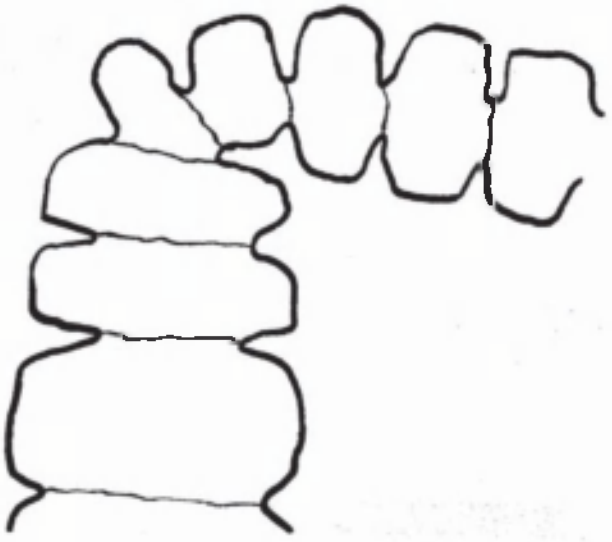
The ileum, in contrast, is rather plain in appearance as the valvulae are almost deficient in that portion of the bowel.

ILEAL PATTERN.



The greatest help is in locating the site of the block in large bowel obstruction. (38). No matter how hypertrophied and out of place is the proximal portion of the bowel, there is always an abrupt ending of the proximal greatly distended air filled colon which stands out in sharp contrast to the blankness beyond the obstruction. The pattern is sacculated as would be expected and the greatest distension is always at the caecum, a point which bears out clinical evidence. (39).

COLONIC PATTERN.



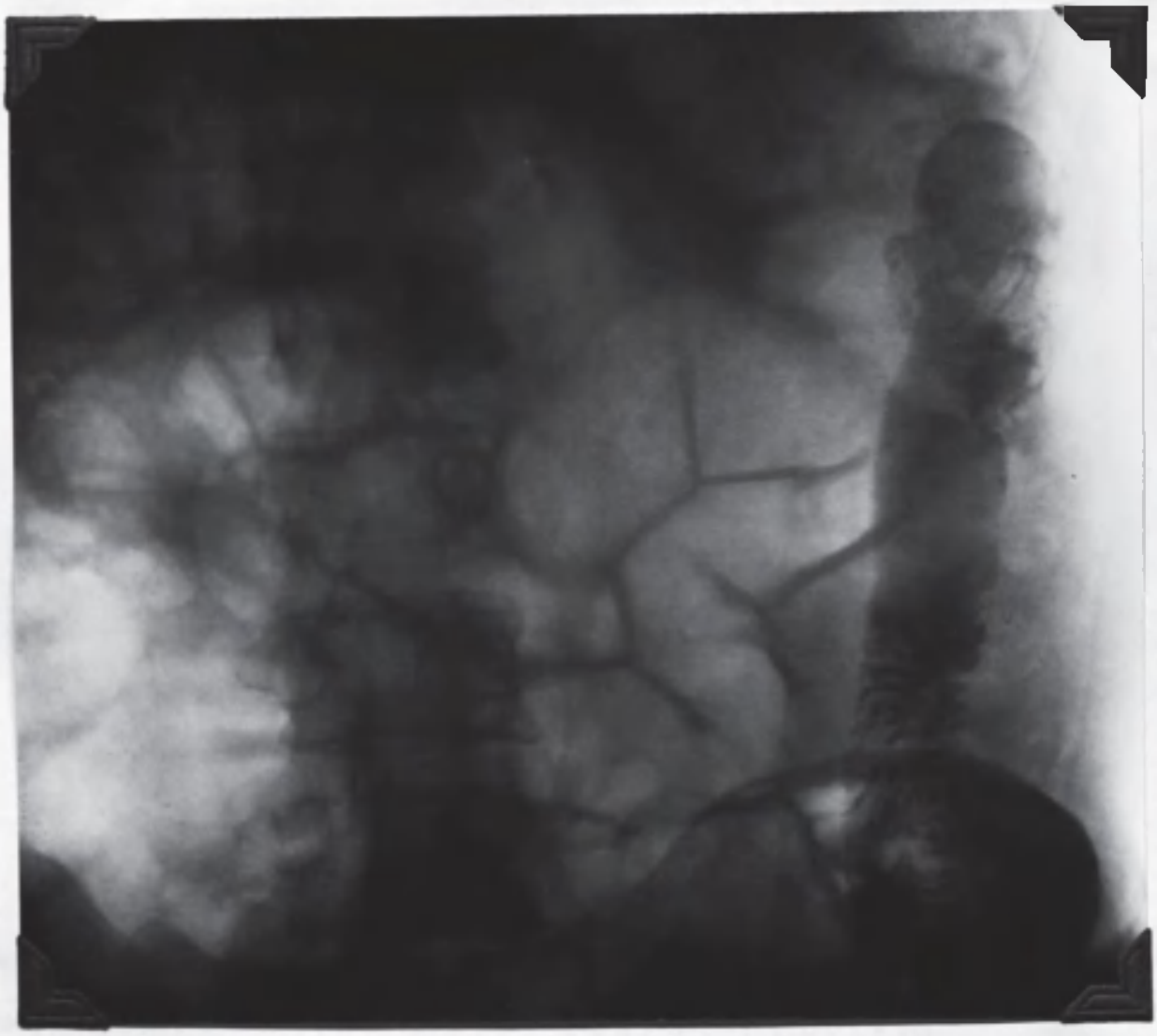


PLATE 1.

Showing ileal distension pattern in a case of carcinoma of the splenic flexure after evacuation of barium enema.

SECTION VII.

TREATMENT.

Owing to the high mortality of acute intestinal obstruction it is not only necessary to diagnose the case accurately as soon as possible, but the appropriate line of treatment must be carried out immediately. This does not necessarily mean that operation should be performed at once, because there are 3 main types of obstruction and each requires a different method of approach.

1. EARLY PERITONITIS TYPE.
    - (a) Strangulated External Herniae.
    - (b) Intussusception.

2. SHOCK TYPE. - Large loop obstructions.
    - (a) Volvulus.
    - (b) Massive Band Obstructions.
    - (c) Strangulated Internal Herniae.

3. TOXIC TYPE.
    - (a) Carcinoma Coli.
    - (b) Small Bands in Lower Ileum.
    - (c) Adhesions.

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1. EARLY PERITONITIS TYPE.

Patients suffering from the strangulated external herniae and intussusception may develop peritonitis at an early stage owing to the liability of perforation of gangrenous bowel and to the transudation of toxins and bacteria. Rarely do they suffer from much shock, and, as they are nearly all admitted to hospital within a few hours of becoming ill, toxaemia is not a regular feature. Immediate operation is the rule, especially as it is easy to operate on both inguinal and femoral hernia under local anaesthesia. (20, 40).

2. SHOCK TYPE.

The shock type are those patients who are suffering from massive loop strangulations in which there is much involvement of the nerve and arterial supply to the bowel. Volvulus, massive band obstructions and the internal herniae are the chief examples. Fortunately, it is the rarest group. Operation must be done fairly soon owing to the possibility of gangrene setting in, but not before some attempt has been made to reduce the degree of shock. (1, 34, 40, 41).

First, radiant heat must be applied, then an intravenous glucose saline should be given, and, if there is much likelyhood of vomiting, a stomach tube should be passed. Many of these cases die as a result of shock before they get to the operating table or soon after the anaesthetic has been administered. This is the immediate danger, not peritonitis, and is comparable to a crushed limb requiring amputation. A delay, then, of two or three hours will get the patient over the worst of the shock and relieve the anaesthetist of much anxiety. (19).

3. TOXIC TYPE.

The toxic type is represented by the carcinomata of the large intestine and by bands and adhesions of the small intestine. The patient may be ill for several days before coming to hospital and, during that time, he is vomiting almost continuously. Thus, he has a very dry and furred tongue, shallow pulse and the other signs of dehydration and toxaemia. He is usually distended, but, on the other hand, there is no sign of peritonitis and little sign of shock. In this type of case, the chemical condition of the body must be improved before operation is attempted.

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PRE-OPERATIVE MEDICATION.

Stomach Tube. If there is either much small bowel distension or vomiting, a stomach tube should be passed and the stomach contents withdrawn. The stomach must not be washed out with bicarbonate solution as this tends to aggravate the condition, there being an alkalaemia present. Better still is continuous duodenal suction which can be continued not only throughout the operation, but after it. (20, 31, 42, 43, 44, 45, 46). Thus is prevented a great possible source of danger, vomiting while the patient is only partly under the anaesthetic. As the pyloric sphincter is open, contents of the duodenum, which are regurgitated, are also withdrawn and so is any gas. (31). In this way distension is also relieved and the intra-abdominal tension lessened for the surgeon. The internal pressure of the bowel is decreased gradually and this may help in preventing a

further fall in blood pressure. (15).

Saline must also be given intravenously, not only to make up the fluid loss but to make good the reduced blood chloride and to lower the blood urea. (19, 34, 47, 48, 49). If the patient has been ill long or has been very sick for 2 - 3 days then it is best that 2 pints of double normal saline be allowed to run intravenously and the time taken should be nearly 1 hour. Given too quickly it may embarrass the heart or cause pulmonary oedema. After that, normal saline should be allowed to drip in for several days at the rate of 6 - 8 pints per day, because it must be remembered that, not only is any fluid swallowed by the patient removed by the suction apparatus, but gastric and duodenal secretions are also withdrawn. The result is that dehydration continues even after the cause of the obstruction has been removed. The saline should contain glucose, and, as the majority of these cases have a low blood pressure and a poor heart action, the addition of ephedrine stimulates them. Hunter (50) recommends:-

Ephedrin hydrochloride		1 grain
Glucose		440 grains
Gum acacia		525 grains
Water	to	1 pint.

Blood. In many of the cases a good deal of anaemia may be present either as a result of carcinomatous bleeding or as a result of a previous operation. Cases with large loop

strangulations lose much blood into the loop and there is often much blood in the peritoneal cavity. These patients should have a transfusion of whole blood dripped in before the normal saline. (20, 29, 51).

Morphia is best withheld before operation. Not only does it mask symptoms but the distress of the patient is due to vomiting and distension rather than actual pain and, as these symptoms are improved by duodenal aspiration, it is not necessary to give morphia straightway. It is surprising, too, the number of patients whose vomiting is increased by morphia. (52). It also slows down the respiration rate, and this is almost fatal in an elderly patient who is very liable to develop chest troubles.

Atropin. Of much more importance than the administration of morphia prior to the operation is the giving of atropin. This drug, given because it is commonly taught that it prevents excessive salivation, has a very important action, namely, it paralyses the endings of the vagus nerve and thus prevents slowing of the heart. (53). In most of the anaesthetic deaths of which the author has had knowledge, this drug had either been omitted or the dose was too small. For an adult he gives 1/75 grain and a baby is given 1/150 grain.

Barbiturates,etc. No drug of this type should be given before the anaesthetic. They abolish consciousness for too great a period and the respiratory and circulatory systems are depressed. They poison the brain which has already been affected by the altered chemical condition of the body.

ANAESTHETICS.

General Anaesthesia is best avoided. Chloroform depresses the cardiac and respiratory systems and alters the blood chemistry. Ether increases the risk of chest infection and the amount of bleeding, and it is often very difficult to get the patient sufficiently deep for the surgeon to close the abdomen properly. For children, it is necessary to give a mixture of chloroform and ether as they are not likely to keep still if a local anaesthetic is used and there is the difficulty of approach and the dosage in the case of a spinal anaesthetic.

Nitrous Oxide. If one has the services of a skilled anaesthetist there is very little objection to nitrous oxide and oxygen anaesthesia. The patient is soon under the anaesthetic so that there is little risk of vomiting and post-operative pneumonia. The objections are that the patient tends to "blow" under the anaesthetic and push the abdominal contents through the wound and that most cases of obstruction enter hospital when only inexperienced anaesthetists are available.

Spinal Anaesthesia is undoubtedly the choice for this type of operation. (1, 35, 36, 41). Vomiting is not a feature and, if it does occur, there is much less risk of "drowning" the patient than is the case when a general anaesthetic is used. If the blood pressure is low, as it often is, and the ephedrin in the saline has not had time to act, 2 minims of adrenalin intravenously will produce marvellous results until it takes effect. The anaesthetic used by the author is

Percaine, and it can be given in safety with the patient on his side, if the head of the table is lowered so that the solution gravitates upwards to the sacral region, as Percaine is less dense than cerebro-spinal fluid.

Local Anaesthesia is all that is necessary for operating on strangulated inguinal and femoral herniae. Most of the subjects are elderly and the saving of a general anaesthetic is a great help in reducing the mortality rate. Very often, too, they are the subjects of spinal osteo-arthritis and it is not always easy to get the needle into the spinal theca. Large abdominal operations can be carried out with local anaesthesia supplemented, when necessary, by nitrous oxide and oxygen.

OPERATION.

Intussusception. The operation for this condition is the classical one of squeezing the sheath gently and milking the intussesceptum backwards. It is rarely necessary to excise the entering portion.

Inguinal Hernia. It is very necessary to open the sac and inspect the contents in this condition. If the bowel is viable it is returned to the abdomen, but, if there be any suspicion of loss of vitality, a resection must be performed. After the excess of sac has been removed and the peritoneum closed, a suture should be passed through the internal ring, consisting of strengthened circular fibres of the transversalis fascia. (54). An attempt should then be made to close the canal in layers to prevent recurrence of the hernia.

Femoral Hernia. The author has found it more satisfactory to operate on strangulated femoral hernia from the abdominal approach through an incision parallel to Poupart's ligament. The peritoneum should be opened at an early stage of the operation and the outgoing undistended loop of bowel should be hooked up to prevent the strangulated part from falling back into the abdomen after it has been released. When this has been done it is an easy matter to inspect the bowel and to perform a resection if necessary.

Umbilical Hernia. Unfortunately, this usually occurs in very stout women and this does not make the operation too easy. The sac is loculated as a rule and the bowel very adherent. Great care is therefore necessary in performing the dissection, and the operation lasts longer than the surgeon desires. An attempt to close the muscles as in Mayo's method should be made.

Ventral Herniae usually occur through an old operation scar which has stretched, particularly if a drainage tube has been used. As the sites vary, the incisions also vary, but the most satisfactory way is to remove the whole scar wherever possible and to treat the hernia as if it were an umbilical hernia, even attempting to overlap muscles or fascial layers as in Mayo's operation, in order to provide a sound scar.

Intra-abdominal Strangulations and obstructions are found either in the right iliac fossa or in the neighbourhood of a previous scar. A volvulus is either in the left side of the pelvis or round an old adhesion, usually tuberculous,

and, therefore, usually in the right iliac fossa. A paramedian incision should be made and, working from the caecum, an examination of the small intestine will eventually reveal the site of the obstruction. The adhesions or bands should be freed and the condition of the bowel noted. If viable, it is further inspected to see that the waves of peristalsis pass on. This is usually very dramatic under spinal anaesthesia. If the bowel is not viable, it is resected. Further examination should be made in case there are more adhesions. If there are and it is necessary to resect at two places, it is better to resect the intervening bowel so as to make one anastomosis, unless there is too great a length between the two points of adhesion. In volvulus the twist must not only be undone, but if there are adhesions at the base, these must be severed. All raw surfaces should be covered with peritoneum in order to prevent a recurrence of adhesions.

If there is a large gangrenous loop of bowel it is often better to bring the loop with its mesentery out of the abdomen and to close the abdomen, having first secured the loop to the edges of the peritoneum in order to prevent it dropping back into the abdomen. (1, 20, 40, 51). This minimises generalised infection of the peritoneum through the gangrenous bowel wall, which, after shock, is the greatest danger of loop obstruction. The skin wound is then protected by vaselined gauze and oiled silk and the gangrenous loop may be removed then or on the following day.

This speeds up the operation as no time is taken over making an anastomosis. (19, 35, 55). In no abdominal crisis is the dictum "Quick in and quicker out" more true than in loop strangulation. 10 days later the patient can be taken back to the theatre and the ileostomy closed and an anastomosis made. It certainly means two operations for the patient, but it nearly always saves his life.

Carcinoma Coli should be X-rayed before operation, to locate the site of the tumour, unless the growth can be palpated per rectum or through the abdominal wall. (34, 37, 38). If the growth is in the sigmoid or rectum, a descending colostomy should be made, if in the descending colon or splenic flexure a transverse colostomy, and if in the ascending colon, hepatic flexure or transverse colon a caecostomy should be performed. A blind caecostomy is a crude type of operation. Even when a caecostomy is done, a large opening should be made by bringing the end of the caecum out of the wound, so that its contents can be evacuated readily. A caecostomy done after the manner of Senn's or Witzel's gastrostomies should never be performed. The conditions are totally different. By leaving sufficient interval between the colostomy and the tumour, space is left to perform a subsequent resection of the growth, providing it is removable, or an anastomosis if it is not, but is should not be so far away that proper drainage and lavage of the bowel cannot be carried out. The growth should not be resected

in a patient with obstructive symptoms. (19, 55). The death rate in this type of obstruction is 40% and most of the patients have been ill for several days before being seen by the surgeon. Resection for carcinoma of the large bowel is a big operation, takes a long time and causes much shock. The obstructive symptoms have been coming on for months as a rule, and the proximal portion of the bowel is hypertrophied in width and in length and it is much wiser to resect when it has assumed a more natural condition. In performing the actual colostomy, a small loop of bowel should be brought out of the wound and the loop not only sewn together at its margins, but it should also be secured to the edges of the peritoneum. This prevents the bowel dropping back into the abdomen and more bowel herniating through the wound.

POST-OPERATIVE TREATMENT.

Salines. These should be continued until all signs of dehydration have disappeared, or, if suction is employed, for about 5 - 6 days. (49, 56, 57). A guide is when the daily urinary output is at least 1 litre. (20).

Suction is kept up until the bowel is functioning normally, the patient's general condition is decidedly improved and the signs of toxaemia and dehydration are removed. This takes 5 - 6 days as a rule.

Radiant Heat should be applied to all cases on their return to bed. It not only helps to combat shock but assists in restoring the function of the bowel. (40). It should not be removed too quickly but rather retained at a lower degree.

There is this objection, however, that excessive heat helps to maintain dehydration by sweating and this must be borne in mind. (58).

Morphia should be given in ¼ grain doses every 5 - 6 hours on the sign of the anaesthetic wearing off or on restlessness. It is most important not only as a means of combating shock but to keep the patient sufficiently quiet and prevent him removing the various tubes which are in him. It has also been proved that it assists in the return of tone to the bowel. (59, 60).

Pituitrin. 1 c.c. may be given intramuscularly but not earlier than 24 hours after operation. It is better to rest the bowel completely first. The injections should not be repeated sooner than 6 hours because commercial forms of pituitrin contain histamine which lowers the blood pressure and a dose repeated too soon may cause a sudden acute lowering of the blood pressure. (61).

Flatus Tube should be passed in all cases. Very often the bowel is active but the patient is too weak to pass flatus through the tight anal sphincters. A small tube is all that is necessary - about $\frac{3}{8}$" bore. The patient may object at first, but if the importance of it is pointed out to him, he usually agrees.

Enemata may be given 24 hours after operation. The ordinary soap enema often makes the patient feel very limp and does not relieve flatus sufficiently. (62). The turpentine enema is too drastic, but a useful addition to a soap enema is 2 drams of household ammonia to the pint of water. This not

only relieves flatus but helps to revive the patient. It should be repeated daily. There is no evidence that an ox-bile enema is any better than soap and water. It acts by lowering surface tension, but the latter is not in evidence, it is an exhausted bowel muscle.

Fluids in small quantities can be taken by mouth as soon as the patient returns to bed and can swallow. There is no eivdence that they cause ileus. (43). If the suction apparatus is employed they are immediately removed, but they give the patient the feeling of his thirst being quenched by wetting his mouth. On the 4th day the suction tube can be removed and the patient given peptonised milk, patent farinaceous milk foods and gelatin table jellies. If there is any sign of sickness the tube should be replaced. On the 5th day chicken tea, milk puddings and bread and butter can be added. Thereafter the diet is gradually increased, but vegetable foodstuffs should not be included for at least 1 month.

Movements. The author places great importance on active and passive movements for all patients after operation. (63, 64). He has noticed repeatedly that patients with a too tidy bed are those who develop phlebitis and pulmonary embolism readily. Free limbs should be moved and deep breathing encouraged. If a patient has had a general anaesthetic, it is a good plan to over-ventilate his lungs by means of carbon dioxide for a few seconds while he is still in the operating theatre.

Position. Most cases are best in a horizontal position for the first 12 hours and then in Fowler's position. (63). The exceptions are the cases suffering from or liable to chest infections. They should be propped up straightway unless shock is very marked.

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COMPLICATIONS.

Collapse should be prevented as far as possible by the use of continuous drip salines and by radiant heat. In some cases it may be necessary to give a blood transfusion either at one infusion or by means of the drip method. If the collapse continues, 2 minims of adrenalin intravenously and the use of carbon dioxide inhalations will help to tide the patient over the crisis.

Paralytic Ileus. If the bowels are not open in 3 days, then paralytic ileus has developed. No sound is heard in the abdomen, no flatus passed, distension tends to increase, vomiting returns and the patient's condition does not improve. A plain X-ray of the abdomen shows the small intestine ballooned out. The withholding of morphia in the early stages of the post-operative illness increases the tendency for this to appear. (36, 65). The condition is a very serious one and, after shock and toxaemia, is the most frequent cause of deaths. Usually it is not recognised until it is too late. It is necessary to do everything possible as quickly as possible. The patient should be given a spinal anaesthetic. This removes inhibitory influences from the cord reaching the

bowel. 1 c.c. of pituitrin is given intra-muscularly and followed in ½ hour by a turpentine enema. Radiant heat should be applied to the abdomen. Duodenal suction should be employed to relieve the distension (66). Finally, Prostigmin 5 c.c. may be used as an injection. (67, 68).

Broncho-Pneumonia may develop early, particularly in elderly patients. The use of ether is to be condemned. They should be given a local anaesthetic aided by nitrous oxide and oxygen if necessary. They should be propped up in bed and a pneumonia jacket applied to them as soon as they return from the operating theatre. A stimulating expectorant mixture is supplied to them, but digitalis is not used unless there is sign of cardiac failure. The use of morphia at night is not contra-indicated as it is much more important that they rest quietly. Oxygen is not used unless there is cyanosis or respiratory difficulty.

Uraemia should not develop unless the kidneys are hopelessly diseased. The patients should be provided with plenty of saline and this should prevent the condition arising. In the case of elderly males it may be necessary to make sure that there is not too much residual urine, and, if there is, a catheter should be tied in until such time as a suprapubic cystostomy is deemed advisable.

Pulmonary Embolism and Phlebitis should be prevented as far as possible and there is no doubt in the author's mind that breathing exercises and movements of free limbs are great preventatives. There is the danger in acute intes-tinal obstruction that, owing to dehydration, the blood is

thicker than normal and therefore clots more readily. If, on the other hand, fluid is administered to the patient continuously, dehydration is made good and clotting is less likely to take place.

Peritonitis is due to gangrenous loops and leaky sutures. It is better to take the gangrenous loop out of the abdomen with sufficient bowel on either side, because the adjacent parts are not usually in a very healthy state. An anastomosis performed at the time of removal of the obstruction is always done with one part of the bowel in a very distended condition. It must be obvious that when this loop returns to normal there will be a bad fit and a possibility of leakage. Therefore, do not anastomose until it has become normal. (19, 55).

If peritonitis develops, it is usually present in 2 - 3 days. The patient should be improving but does not. Instead, his temperature and pulse rate are rising or are keeping up. The best test is the author's modification of rebound tenderness. He noticed that patients were afraid of being hurt by the surgeon's examining hand and that there was reflex guarding of the muscles. It was therefore necessary to gain the patient's confidence and at the same time to make sure that the patient understood what was asked of him. The author always explains that he is going to put his hand on the patient's abdomen and that he would like to know whether the pain is worse (1) on putting the hand on, (2) on keeping it on for a few minutes, or (3) on taking it off. If peritonitis is present, the removal of the hand is always worse, much to the patient's surprise and often to his distress. This test

never fails and if it is present a laparotomy should be performed and the abdomen thoroughly drained.

Sub-phrenic Abscess is, fortunately a relatively rare complication owing to the fact that very few cases develop peritonitis. If the temperature rises on the 7th or succeeding days the suspicion is that a sub-phrenic abscess has developed. The chest should be carefully examined and the portable X-ray apparatus used to detect any alteration in the diaphragmatic regions. If there is, then the sub-phrenic space must be opened and drained by the route, usually the transpleural, which is likely to give the best drainage.

Cerebral Thrombosis may occur and it may be almost impossible to irradicate it in an elderly subject whose arteries are greatly degenerated. Nevertheless, by attempting to restore dehydration and by the continued use of glucose salines, this complication may be reduced to a minimum.

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SECTION VIII.

CASES.

During the year 1938, 43 cases of acute intestinal obstruction were admitted to the Royal Sussex County Hospital, Brighton. There were 6 deaths and 37 patients recovered. This is a death rate of 13·95%. At Croydon General Hospital during the years 1931 - 6 and the Royal Sussex County Hospital during the years 1932 - 6, 361 cases were admitted with 112 deaths, a death rate of 31·02%. There was very little difference in the rate for individual years.

	CASES.	DEATHS.	RECOVERIES.	DEATH RATE.
R.S.C.H. 1932-6 C.G.H. 1931-6	361	112	249	31·02%
21 Brit. Hosps. 1925-30. (2).	6,892	1,806	5,086	26·2%
U.S.A. 1929 (1).	343	209	134	60·9%
U.S.A. 1934 (1).	505	205	300	40·6%
R.S.C.H. 1938.	43	6	37	13·95%

CAUSES.	TOTAL.		DEATHS.		RATE %.	
	1st Series.	2nd Series.	1st Series.	2nd Series.	1st Series.	2nd Series.
IMPACTION.	2	-	-	-	-	-
VOLVULUS OF S.I.	19	1	10	-	52·6	-
INT. HERNIA.	1	-	-	-	-	-
ADHESIONS. OP.	27	6	10	-	37·03	-
" . T.B.	50	4	14	1	28	25
INGUINAL HERNIA.	63	11	8	1	12·9	9
FEMORAL HERNIA.	69	7	13	-	18·8	-
UMBILICAL HERNIA.	8	2	3	2	37·5	100
VENTRAL HERNIA.	12	1	6	-	50	-
CARCINOMA S.I.	2	-	1	-	50	-
INTUSSUSCEPTION.	20	3	3	-	15	-
VOLVULUS OF SIGM.	6	-	3	-	50	-
CARCINOMA CAEC.	5	1	3	-	60	-
" ASC. COL.	5	-	2	-	40	-
" HEPATIC.	4	-	3	-	75	-
" TRANSV.	9	1	4	-	44.4	-
" SPLEN.	2	2	1	-	50	-
" DESC.	8	1	4	-	50	-
" SIGM.	35	3	15	2	42·9	66·6
" RECT.	14	-	9	-	64·2	-

SMALL BOWEL OBSTRUCTION.

	CASES.	DEATHS.	RATE %.
1st Series.	253	65	25·7
2nd Series.	32	4	12·5

LARGE BOWEL OBSTRUCTION.

	CASES.	DEATHS.	RATE %.
1st Series.	108	47	43·5
2nd Series.	11	2	18·2

As the external herniae form the largest and most easily diagnosed group, it is interesting to compare the rates.

EXTERNAL HERNIAE.

	CASES.	DEATHS.	RATE %.
1st Series.	152	30	19·7
2nd Series.	21	3	14·3

Obstruction by carcinoma of the large intestine comes on rather insidiously and it is often days before the patient is admitted to hospital.

CARCINOMA COLI.

	CASES.	DEATHS.	RATE %.
1st Series.	82	41	50
2nd Series.	8	2	25

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INDIVIDUAL CASES.

CASE 1 was a man, aged 65, who complained of abdominal pain and vomiting for 3 days. He had had no bowel action for 3 days. There was no history of blood or mucous in the motion.

He did not look ill but his tongue was dry and furred. His abdomen was distended but was not particularly tender. There was much ballooning of the caecum and ascending colon. The descending colon was not palpable. T. 99°. P. 76.

Plain X-ray of the abdomen showed an obstruction at the splenic flexure. (Plate No. 2). Urinary chlorides were absent. Blood urea was 100 mgm., and the plasma chlorides were 511 mgm.

1 pint of glucose saline was given intravenously prior to operation and $\frac{1}{75}$ gr. atropin. A general anaesthetic of 2 parts of chloroform and 3 parts of ether was administered. A right paramedian incision was made and a ring carcinoma was found in the splenic flexure. Secondary deposits were palpable in the liver and peritoneum. As these were present, a possible resection later was ruled out, and so an ileo-sigmoidostomy was performed. The abdomen was closed. The intravenous drip saline was continued and radiant heat applied to the abdomen. The patient made an uneventful recovery.

CASE 2 was a boy, aged 2, who was brought to hospital because he had been screaming and drawing up his legs for 12 hours. His bowels had been open 4 hours previously and the motion consisted of almost pure blood.

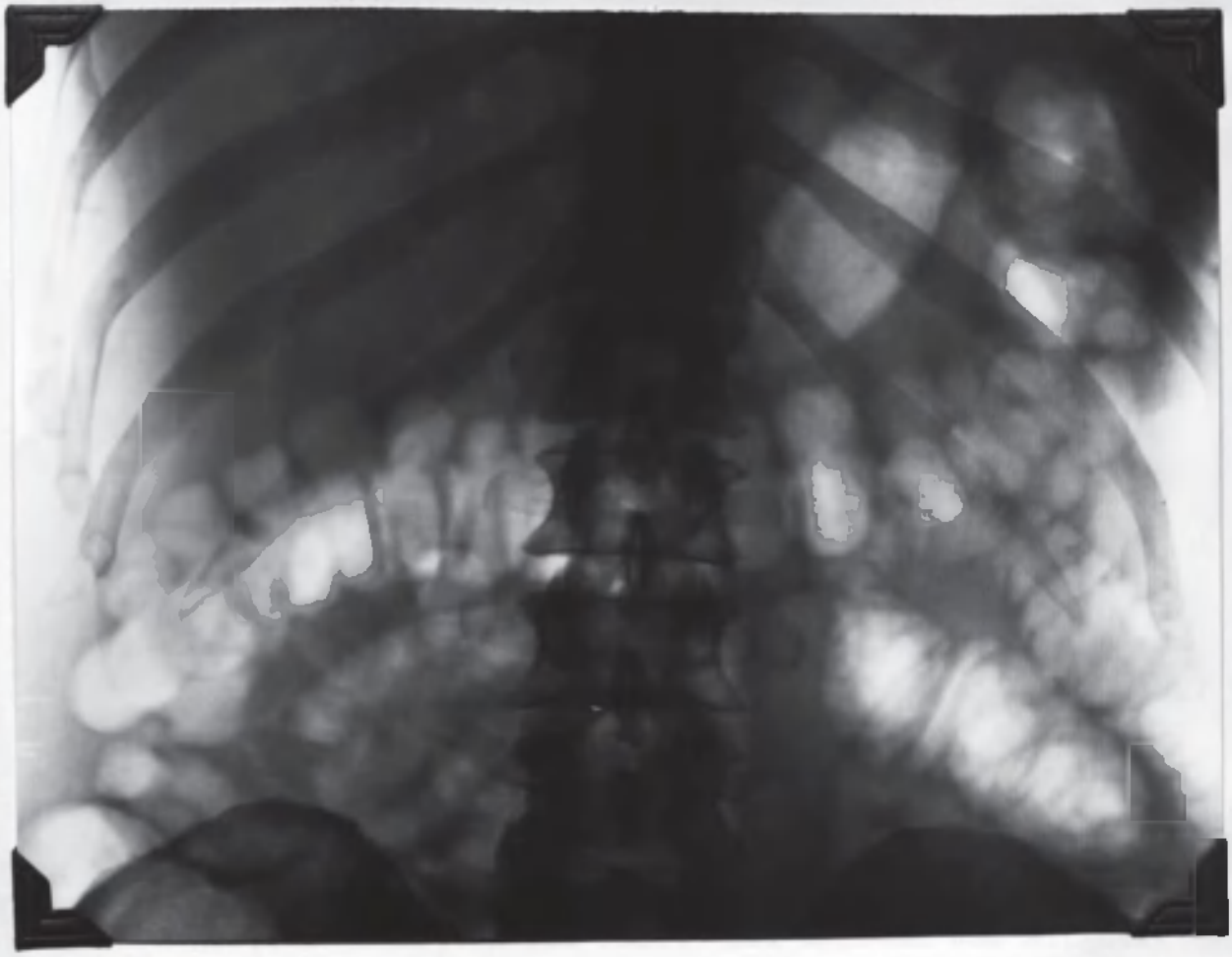

PLATE 2.

CASE 1. Plain X-ray of the abdomen showing obstruction at the splenic flexure.

He was a well developed child but very pale. A mass was palpable in the right hypochondrium and there was "emptiness" in the right iliac fossa. T. 100°. P. 140.

Plasma chlorides were 585 mgm. and the blood urea was 20 mgm. He was given $\frac{1}{150}$ gr. atropin before operation.

Ether was used as the anaesthetic. A right paramedian incision was made and an ileo-colic intussusception was found. This was reduced and the abdomen closed. He made an uneventful recovery.

CASE 3. This patient was a woman, aged 70, who complained of pains in a previously existing right femoral hernia and in the lower abdomen for 12 hours. She vomited at the commencement of the pain but not afterwards. Bowels had not been open for 2 days.

Her general condition was fair. Her abdomen was slightly distended. The hernia was very tender. T. 98·2°. P. 80.

Plasma chlorides were 569 mgm. and the blood urea was 50 mgm. 1 c.c. ephedrin was given intramuscularly. 10 c.c. Percaine were administered as a spinal anaesthetic.

During the operation, strangulated small intestine was found. The bowel was viable, and was returned to the abdomen. Rectal drip salines were given on return to bed and the patient made an uneventful recovery.

CASE 4 was a woman of 61, who complained of pain in the left femoral region associated with the appearance of a lump there. The illness had commenced 12 hours previously. She had been

sick at the onset only and her bowel had also acted then.

There was, on examination, a tender irreducible left femoral hernia. T. 99·2°. P. 86. Plasma chlorides were 585 mgm. and the blood urea was 40 mgm.

Pre-operative treatment consisted of $\frac{1}{75}$ gr. atropin. A general anaesthetic consisting of chloroform 2 parts and ether 3 parts was administered. A loop of small intestine was found to be strangulated, but it was viable and was returned to the abdomen. Rectal drip salines were given on return to bed and the patient made an uneventful recovery.

CASE 5 was a woman, aged 76, who complained of general abdominal pains for 7 days. She was sick for 7 days and her bowel had not acted during that time. There was a history of previously existing and increasing constipation with blood and mucous in the motions.

The patient looked ill. Her tongue was very dry and sordes were present in the mouth. The abdomen was distended, particularly in the flanks. Rectal examination was negative. T. 98°. P. 122.

Plain X-ray of the abdomen showed enormous distension of the ascending and descending colons with obstruction of the descending colon just below the crest of the ileum. (Plate No. 3). The urine contained no chlorides. The plasma chlorides were 478 mgm. and the blood urea was 160 mgm.

1 pint of glucose saline was given immediately and the continuous drip saline followed. 1 c.c. of ephedrin was given intra-muscularly. The anaesthetic was 10 c.c. of Percaine

PLATE 3.

CASE 5. Plain X-ray of the abdomen showing obstruction of descending colon with marked distension of caecum and ascending colon.

given intrathecally. The operation consisted of making a transverse colostomy. The drip saline was continued after operation and the patient made an uneventful recovery.

CASE 6 was a boy, aged 1, who had been screaming and drawing up his legs for 1 day. He had passed a "red-currant jelly" motion at the onset.

He was well developed but very pale and lay with his legs drawn up. Examination revealed a sausage shaped tumour in the region of the transverse colon and "emptiness" in the right iliac fossa. T. 98°. P. 120. Plasma chlorides were 552 mgm. and the blood urea was 30 mgm. A Barium enema showed an obstruction at the beginning of the transverse colon. (Plate No. 4).

He was given $\frac{1}{150}$ gr. atropin before operation. The anaesthetic was ether. A right paramedian incision was made and a right ileo-colic intussusception found and reduced. Thereafter the abdomen was closed and convalescence was uneventful.

CASE 7 was a man, aged 65, who complained of pains round an old umbilical hernia for 3 days. He had been vomiting for 3 days and the vomits had become faecoid. The bowel had not acted for 4 days.

The patient was very emaciated and looked very ill. His tongue was furred and very dry. The abdomen was distended greatly and there was an umbilical hernia about the size of a large egg. T. 98·4°. P. 98.

PLATE 4.

CASE 6. Barium enema showing obstruction in the transverse colon.

The urine contained no chlorides. Plasma chlorides were 462 mgm. and the blood urea was 240 mgm.

Pre-operative treatment consisted of giving 1 pint of intravenous glucose saline and then the continuous drip saline intravenously. The anaesthetic was 1% novocain injected locally. At the operation, small intestine was very adherent, but viable, and was eventually freed. A repair was done as in Mayo's method. On his return to bed, the drip saline was continued and radiant heat applied to the abdomen, but he died 10 hours after operation.

CASE 8. This patient, a woman aged 70, complained of abdominal pains for 3 days. Vomiting had been almost continuous for 3 days and there had been no bowel action for almost 6 days. There was a history of increasing constipation for some months previously but there was no visible blood in the motions.

The patient looked very ill. Her tongue was dry and sordes were present. There was no distension of the abdomen. T. 98°. P. 86. Blood pressure 170/100. The urine contained no chlorides. The plasma chlorides were 503 mgm. and the blood urea was 90 mgm. Barium enema showed obstruction in sigmoid. (Plate No. 5).

1 pint of glucose saline was given intravenously before operation and continued as a continuous drip saline. $\frac{1}{75}$ gr. atropin was also given. The anaesthetic consisted of 2 parts of chloroform and 3 parts of ether. A right paramedian incision was made and an annular carcinoma at the junction of the descending and sigmoid colons found. An ileo-

PLATE 5.

CASE 8. Barium enema showing obstruction in the sigmoid. Plate also shows gaseous distension above the obstruction.

sigmoidostomy was performed.

After, operation, the intravenous drip saline was continued and radiant heat was applied to the abdomen. The patient died on the 4th day after operation. Post-mortem examination revealed that death was due to peritonitis owing to leakage of anastomosis.

CASE 9 was a man, aged 22, who complained of pain in the right inguinal region and a lump appeared which he could not disperse. Vomiting had been in existence for 1 day only and bowels had been open on the previous day.

He appeared fairly comfortable. There was no distension of the abdomen. There was a right inguinal irreducible hernia. T. 98°. P. 80. Plasma chlorides were 610 mgm. and the blood urea was 50 mgm.

$\frac{1}{75}$ gr. atropin was given and the anaesthetic was chloroform 2 parts, ether 3 parts. At operation, a small knuckle of small intestine was found strangulated but viable, and was returned to the abdomen. The hernia was repaired and the patient made an uneventful recovery.

CASE 10 was a woman, aged 73, who complained of pain in a previously existing right femoral hernia which had become much larger. She had been ill for 1 day. Vomiting had set in with the onset of the pain. There had been no bowel action since the start of the illness.

She did not look ill, but her tongue was dry and furred. There was no abdominal distension, but a small tender irreducible right femoral hernia was present. T. 98·2°. P. 70.

Blood pressure 130/75. Plasma chlorides were 594 mgm. and the blood urea was 60 mgm.

She was given 1 pint glucose saline intravenously and it was continued by the continuous drip method. 1 c.c. ephedrin was given intramuscularly and the anaesthetic was 10 c.c. Percaine intrathecally. During the operation, a small loop of small intestine was found strangulated, was only just viable, but was returned to the abdomen. The intravenous drip saline was continued after her return to bed and she made an uninterrupted recovery.

CASE 11. This patient, a woman aged 63, complained of pains on the right side of the abdomen moving over to the left side, for 7 days. Bowels had not moved for 7 days. Vomiting had been in existence for 4 days. There was a history of previous constipation.

She looked ill and toxic. Her tongue was very dry and furred. The abdomen was greatly distended. Caecum and ascending colon were very distended but the descending colon was not palpable. T. 97°. P. 120. Blood pressure 155/80.

Plain X-ray of the abdomen showed great distension of the caecum and ascending colon with an obstruction in the transverse colon. (Plate No. 6). Urinary chlorides were absent. The plasma chlorides were 495 mgm. and the blood urea was 120 mgm.

1 pint of glucose saline was given intravenously and continued by the drip method. 1 c.c. of ephedrin was given intramuscularly. The anaesthetic was 10 c.cs. Percaine

PLATE 6.

CASE 11. Plain X-ray of abdomen showing obstruction in the transverse colon.

intrathecally. A right paramedian incision was made and a ring carcinoma was found in the transverse colon. Secondaries were present in the liver. An ileo-sigmoidostomy was performed. The intravenous drip saline was continued after operation and radiant heat applied to the abdomen. The patient had an uninterrupted convalescence.

CASE 12. This patient, a woman aged 42, complained of pain in the epigastrium for 3 days. Vomiting had commenced 2 days previously and bowels had not acted for 1 day. She had had a previous gall bladder operation.

She did not look ill, but her tongue was dry and furred. Distended coils of bowel were visible round the previous scar. T. 98°. P. 116. Blood pressure 120/80. Plasma chlorides = 528 mgm. Blood urea = 120 mgm.

She was given $\frac{1}{75}$ gr. atropin and the anaesthetic consisted of chloroform 2 parts, Ether 3 parts. The scar was excised and adhesions of the small intestine divided. All the bowel was viable so the abdomen was closed. The intravenous drip saline was continued and radiant heat applied to the abdomen on the patient's return to bed. Thereafter she made an uneventful recovery.

CASE 13 was a man, aged 75, who complained of pain in a previously existing left inguinal hernia for 8 hours. It had become irreducible since the onset of the illness. He had been sick at the commencement and bowels had been opened on the previous day.

He did not look well. His tongue was very dry and brown. There was a large irreducible and very tender left inguinal hernia. T. 97°. P. 112. Blood pressure 150/100. Plasma chlorides = 610 *mgm*. Blood urea = 120 *mgm*.

$\frac{1}{75}$ gr. atropin was given and the anaesthetic was N_2O and O_2. At operation, the hernial sac contained a loop of strangulated sigmoid colon. This was viable, so was returned to the abdomen and the hernia repaired. Rectal drip salines were administered on his return to bed and he made an uneventful recovery.

CASE 14 was a man, aged 52, who complained of pain in a previously existing left inguinal hernia for 12 hours. He had been sick at the onset and bowels had been open prior to the commencement of the pain. He could not reduce the hernia as hitherto. He did not look ill and his tongue was dry but clean.

There was a left inguinal hernia, irreducible and slightly tender. T. 97·6°. P. 72. Plasma chlorides = 585 mgm. Blood urea = 50 mgm.

He was given $\frac{1}{75}$ gr. atropin and the anaesthetic was chloroform 2 parts, Ether 3 parts. At operation, a loop of small intestine was found strangulated but viable, and was returned to the abdomen. The hernia was repaired. Rectal drip salines were administered on his return to bed and he made an uninterrupted recovery.

CASE 15 was a boy, aged 10, who complained of generalised abdominal pain for 1 day. He had been sick at the onset and bowels had not been opened for 1 day.

He looked extremely ill and shocked. His tongue was dry. The abdomen was distended, very tender and rigid. Rebound tenderness was present. T. 96°. P. 110.

Plain X-ray of the abdomen showed small bowel obstruction. (Plate No. 7). Plasma chlorides = 585 *mgm.* Blood urea = 40 *mgm.*

He was given $\frac{1}{100}$ gr. atropin. The anaesthetic was N_2O and O_2. A right paramedian incision was made and blood stained fluid escaped from the abdomen. 2' of terminal ileum was found to be gangrenous and it had been strangulated from adhesions between tuberculous glands. The adhesions were freed and the mesentery ligated and severed. The gangrenous loop, with a portion of the pink loop, was exteriorised and the abdomen closed as in a colostomy. A suprapubic stab drain was also made. Intravenous drip salines were given continuously and radiant heat was applied on his return to bed.

On the following morning, the gangrenous loop was removed and Paul's tubes inserted into both free ends of live bowel. Rubber tubing was then connected to the ends of the Paul's tubes so as to form an artificial bowel. On the 2nd day the bowel was opened by means of enemata and liquid paraffin was given by mouth every 4 hours. On the 3rd day the bowel was again opened by enemata and on the 4th day the bowel acted normally. On the 12th day a side to side anastomosis of ileum was performed and the ileostomy closed. Thereafter the boy had an uninterrupted recovery.

CASE 16. This patient, a man aged 67, complained of pain in a previously existing left inguinal hernia for 2 days.

PLATE 7.

CASE 15. Plain X-ray of the abdomen showing enormous distension of the whole of the small intestine. Therefore, obstruction is in the ileo-caecal region.

Since then it had become irreducible. He had been sick for 1 day and the bowel had not acted for 1 day.

He did not look ill, but his tongue was very dry and furred. He had a left inguinal hernia which was very tender. T. 100·4°. P. 90. Plasma chloride = 561 mgm. Blood urea = 208 mgm.

1 pint glucose saline was given intravenously and continued by means of the continuous drip method. Atropin gr. $\frac{1}{75}$ was also given. The anaesthetic used was ether. At operation, a small loop of ileum was found strangulated but was viable and so returned to the abdomen. The hernia was repaired. The convalescence was uneventful.

CASE 17 was a woman, aged 64, who complained of generalised abdominal pains, particularly on the right side for 4 days. Vomiting had been in evidence for 2 days. Bowels had not been open for 4 days. There was a history of previous constipation but no melaena.

She looked very well but her tongue was very dry and brown. Her abdomen was distended and the caecum and ascending colon were much ballooned. The descending colon was not palpable. T. 98°. P. 80. B.P. 130/80. Plain X-ray of the abdomen showed an obstruction at the splenic flexure. (Plate No. 8). Urinary chlorides were absent. Plasma chlorides = 544 mgm. Blood urea = 80 mgm.

2 pints of glucose saline were administered and salines were continued by means of the continuous drip methods.

PLATE 8.

CASE 17. Plain X-ray of the abdomen showing obstruction at the splenic flexure.

Atropin gr. $\frac{1}{75}$ was also given. The anaesthetic was N_2O and O_2. A caecostomy was performed. The continuous drip salines were continued after operation and radiant heat applied to the abdomen. She made an uneventful recovery.

CASE 18 was a man, aged 59, who complained of generalised abdominal pain for 8 days. There had been no bowel action for 8 days. Sickness had been present for 6 days. He gave a history of increasing constipation and the passage of blood stained slime for 4 months previously.

He looked ill. His tongue was very furred and sordes were present. His abdomen was very distended. T. 98·4°. P. 100. Blood pressure 180/90. Plain X-ray of the abdomen showed an obstruction near the beginning of the sigmoid colon. (Plate No. 9). Urinary chlorides were absent. Plasma chloride = 462 mgm. Blood urea = 160 mgm.

2 pints of glucose saline were administered intravenously and salines continued by the continuous drip method. $\frac{1}{75}$ gr. atropin was also given. The anaesthetic was chloroform 2 parts, Ether 3 parts. A right grid-iron incision was made and a caecostomy made as in Senn's gastrostomy. The drip saline was continued and radiant heat applied to the abdomen, but the caecostomy did not act and the patient died on the 8th day after operation.

CASE 19. This patient, a man aged 64, complained of pain round an old umbilical hernia for 36 hours. Bowels had not opened for 2 days. He had been vomiting frequently during the previous 24 hours.

PLATE 9.

CASE 18. Plain X-ray showing obstruction at the beginning of the sigmoid colon.

He was very ill and very cyanosed. Tongue was very dry and dirty. His abdomen was distended and there was an irreducible umbilical hernia about the size of a large plum. T. 98°. P. 116. Urinary chlorides were absent. Plasma chlorides = 544 mgm. Blood urea = 180 mgm.

1 pint of glucose saline was given intravenously and was continued by the drip method. He was also given $\frac{1}{100}$ gr. digitalin and $\frac{1}{75}$ gr. atropin. The anaesthetic was N_2O and O_2. An elliptical incision, including the hernia, was made. Small intestine was very adherent and was separated with much difficulty. The bowel was viable. The abdominal wall was repaired as in Mayo's method.

The continuous drip saline was continued after operation. Radiant heat was applied to the patient's abdomen, but he died 4 hours later. Post-mortem examination revealed extensive atheroma and chronic cardiac failure.

CASE 20 was a woman, aged 68, who complained of pain and a lump in her left femoral region of 1 day's duration. She was sick when the lump appeared. There had been a bowel action on the previous day.

She did not look ill and her tongue was moist. There was an irreducible left femoral hernia, slightly tender. T. 99°. P. 76. Plasma chloride = 577 mgm. Blood urea = 50 mgm.

She was given atropin gr. $\frac{1}{75}$. The anaesthetic was chloroform 2 parts, Ether 3 parts. Small intestine was strangulated, but was viable and so it was returned to the abdomen. After the operation, rectal drip salines were given and she made an

uneventful recovery.

CASE 21 was a woman, aged 59, who complained of pain round an old hysterectomy scar for 12 hours. Bowels had not been opened for 1 day and vomiting had been in existence for 8 hours.

She did not look ill and her tongue was not dry. Her abdomen was slightly distended. T. 96°. P. 78. Plasma chlorides = 595 mgm. Blood urea = 60 mgm.

1 pint of glucose saline was given intravenously and salines were continued by the intravenous drip method. She was also given atropin gr. $\frac{1}{75}$. The anaesthetic was chloroform 2 parts, Ether 3 parts. At operation, it was found that small intestine was adherent to the hysterectomy scar and the bowel was badly kinked. It was deemed advisable to resect 14" of bowel and an end to end anastomosis was performed. Thereafter, the abdomen was closed. The drip saline was continued, radiant heat was applied to the abdomen and the patient made an uninterrupted recovery.

CASE 22. This patient, a woman aged 43, complained of pain and a lump in the right femoral region for 1 day. At the onset she was sick, and there had been no bowel action for 1 day.

She did not look ill and her tongue was moist. She had an irreducible tender right femoral hernia. T. 99.6°. P. 80. Blood pressure 125/90. Plasma chlorides = 618 mgm. Blood urea = 40 mgm. Pre-operative medication consisted of

the administration of $\frac{1}{75}$ gr. atropin. The anaesthetic was chloroform 2 parts, Ether 3 parts. At operation, small bowel was found strangulated but viable. The bowel was returned to the abdomen. After operation she was given rectal salines and radiant heat to the abdomen. Convalescence was uneventful.

CASE 23 was a woman, aged 48, who complained of pain and a lump in the left femoral region for 12 hours. Vomiting had been in progress since the onset and bowels had not acted for 1 day. She did not look ill and her tongue was moist. There was, on examination, a tender irreducible left femoral hernia, but there was no distension of the abdomen. T. 98·2°. P. 104. Blood pressure 180/130. Plasma chlorides = 585 mgm. Blood urea = 70 mgm.

She was given $\frac{1}{75}$ gr. atropin, and the anaesthetic used was 12 c.c. Percaine intrathecally. The operation revealed strangulated loop of small intestine. The bowel was viable, and so was returned to the abdomen. After operation she was given rectal drip salines and she made an uneventful recovery.

CASE 24. This patient, a man aged 67, complained of pain round a right paramedian appendix scar. He had been ill 1 day and vomiting had been in evidence since the onset. There had been no bowel action for 1 day.

He did not look ill, but his tongue was very dry. There was slight abdominal distension with visible peristalsis round the scar. T. 97°. P. 100. Plasma chlorides = 602 mgm. Blood urea = 80 mgm.

Before operation he was given $\frac{1}{75}$ gr. atropin and the anaesthetic was gas and oxygen. The thin-walled sac was excised and the adhesions removed. The small intestine was viable and was returned to the abdomen, which was closed in layers. After operation he was given radiant heat to the abdomen and rectal drip salines and he made an uninterrupted recovery.

CASE 25 was a man, aged 76, who complained of pain in the left side of the abdomen for 1 day. He had been continuously sick for 1 day and his bowels had not been open since the onset of the illness.

He did not look ill, but his tongue was very dry and brown. There was no detectable distension of the abdomen, but descending colon was enlarged. T. 98·4°. P. 74. Urinary chlorides absent. Plasma chlorides = 544 mgm. Blood urea = 90 mgm.

Before operation he was given atropin gr. $\frac{1}{75}$. The anaesthetic was nitrous oxide and oxygen. A left paramedian incision was made and a band over the lower end of the descending colon removed. On his return to bed, rectal drip salines were administered, as was radiant heat, and the patient made an uninterrupted recovery.

CASE 26 was a man, aged 46, who complained of pain and a lump in his right inguinal region of 4 hour's duration. He was sick at the onset and bowels had not been open for 24 hours. He did not look ill and his tongue was moist. There was an irreducible tender right inguinal hernia. T. 98·8°. P. 70.

Plasma chlorides = 594 mgm. Blood urea = 40 mgm. No pre-operative was given. The anaesthetic was 13 c.cs. of Percaine intrathecally. At operation, a loop of small intestine was found strangulated but was viable and was returned to the abdomen. The hernia was repaired. On his return to bed, the patient was given rectal drip salines and he made an uninterrupted recovery.

CASE 27. This patient, a man aged 50, complained of pain in a previously existing reducible inguinal hernia for 2 days. It did not now reduce. He had been sick for 2 days and bowels had not operated for 1 day.

He did not appear ill, but his tongue was very dry. There was a large tender irreducible right inguinal hernia. T. 98·4°. P.58. Plasma chlorides = 602 mgm. Blood urea = 70 mgm.

He was given 1 c.c. ephedrin intramuscularly and the anaesthetic was 10 c.c. Percaine intrathecally. At operation, a small loop of small intestine was found strangulated but viable, and was returned to the abdomen. The Hernia was repaired. On his return to bed the patient was given rectal drip salines and he made an uninterrupted recovery.

CASE 28 was a woman, aged 47, who complained of abdominal pain for 16 hours. She had been sick for 12 hours and her bowels had not been open for 1 day.

She did not look very ill, but her tongue was dry. There was a small tender irreducible right femoral hernia. T. 98·6°. P. 96. Plasma chlorides = 602 mgm. Blood urea = 60 mgm.

Before operation she was given 1 c.c. ephedrin intramuscularly. The anaesthetic was 10·5 c.cs. of Percaine intrathecally. At operation, a small loop of bowel was found to form a strangulated Richter's hernia, but the bowel was viable and it was returned to the abdomen. After her return to bed she was given rectal drip salines and she made an uninterrupted recovery.

CASE 29 was a woman, aged 55, who complained of upper abdominal pains for 6 hours. She had been vomiting since the onset. There had been no bowel action for 8 hours prior to admission.

She did not look ill and her tongue was moist. She was tender in the right iliac fossa and around the scar of an old salpingectomy. T. 99°. P. 84. Plasma chlorides = 610 mgm. Blood urea = 40 mgm.

Before operation she was given $\frac{1}{75}$ gr. atropin. The anaesthetic was chloroform 2 parts, Ether 3 parts. The scar was excised. Small intestine was very adherent to it and the bowel was strangulated. The adhesions were freed and the abdomen closed in layers. After operation she was given rectal drip salines, and she made an uninterrupted recovery.

CASE 30 was a woman, aged 83, who complained of pain and swelling in the right inguinal region of 1 day's duration. She had been repeatedly sick since the onset and there had been no bowel action since the previous day.

Her general condition was very poor and her tongue was dry and dirty. Examination revealed an irreducible tender right inguinal hernia. T. 98·6°. P. 96. Plasma chlorides = 561 mgm. Blood urea = 120 mgm.

She was given 1 c.c. ephedrin intramuscularly before operation. The anaesthetic used was 10 c.c. Percaine intrathecally. Thereafter the patient collapsed and died before the operation was performed.

CASE 31 was a man, aged 82, who complained of pain in a previously existing right inguinal hernia of 12 hours duration. He had been very sick at the onset and his bowel had acted earlier in the day.

His general condition was fair, but his tongue was dry. Examination revealed a large tender irreducible right inguinal hernia. T. 97°. P. 104. Plasma chloride = 569 mgm. Blood urea = 90 mgm.

He was given 1 c.c. sphedrin intramuscularly before operation, and the anaesthetic was 10 c.cs. Percaine intrathecally. At operation, the free end of the caecum was found strangulated in the sac. The bowel was viable and was returned to the abdomen. A repair operation was performed. After operation he was given rectal drip salines and he made an uninterrupted recovery.

CASE 32 was a boy, aged 10, who complained of generalised abdominal pain for 12 hours. He had been sick at the onset, but there had been no bowel action since the previous day. The motions had been normal.

His general condition was good. An examination revealed a tender mass in the right hypochondrium and an emptiness in the right iliac fossa. T. 99°. P. 92. Plasma chlorides = 602 mgm. Blood urea = 40 mgm.

Before operation he was given $\frac{1}{100}$ gr. atropin. The anaesthetic was chloroform 2 parts, ether 3 parts. A right paramedian incision was made and a caecal intussusception was found in the right hypochondrium. It was reduced and the abdomen closed. After operation he was given rectal drip salines and he made an uninterrupted recovery.

CASE 33. This man, aged 59, complained of pain in the abdomen for 4 days. He had been continuously sick for 3 days and there had been no bowel action for 4 days.

His general condition was fair, but his tongue was very dry and dirty. His abdomen was distended, particularly in the region of the colon. T. 98°. P. 84. Blood pressure = 235/140. Plain X-ray of the abdomen revealed an obstruction in the upper part of the sigmoid. (Plate No. 10). The urine contained no chlorides.
Plasma chlorides = 519 mgm. Blood urea = 100 mgm.

Before operation, a stomach tube was passed and the stomach was washed out with saline. Then he was given an intravenous drip saline and 1 c.c. ephedrin intramuscularly.

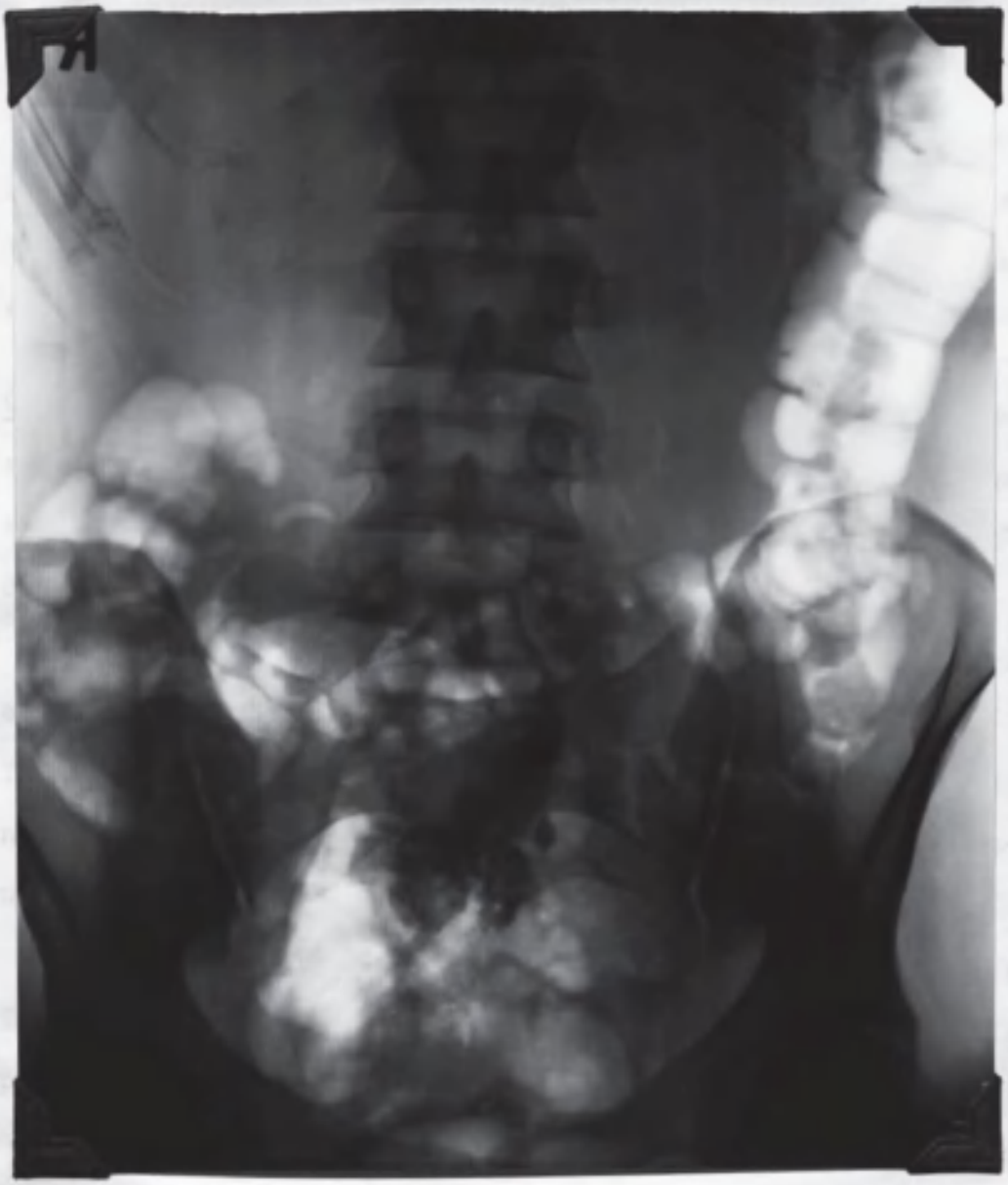

PLATE 10.

CASE 33. Plain X-ray of the abdomen showing obstruction at the beginning of the sigmoid colon.

The anaesthetic was 12 c.c. Percaine intrathecally. A right grid-iron incision was made and a large rubber tube sewn into the caecum. After operation the continuous drip saline was continued and he made an uneventful recovery.

CASE 34 was a man, aged 72, who complained of generalised abdominal pains of 3 days duration. He had been continuously sick since the onset. There had been no bowel action for 1 day.

His general condition was not too good. He was obese and slightly cyanosed. His tongue was very dry. T. 98°. P. 86. Blood pressure 140/70. His urine contained no urinary chlorides. Plasma chlorides = 503 mgm. Blood urea = 128 mgm.

Before operation he was given an intravenous drip saline. The anaesthetic was 10 c.cs. Percaine intrathecally. The patient collapsed and died before operation was commenced.

A Post-mortem examination revealed a loop obstruction of small bowel in the right iliac fossa from old tubercular adhesions. Death was accelerated by fatty degeneration of the heart.

CASE 35. This man, aged 66, complained of generalised abdominal pains for 10 days. He had been vomiting at intervals for 10 days and his bowels had not been opened for 4 days.

His general condition seemed good and his tongue was moist. Examination revealed generalised abdominal distension with no localised tenderness.

T. 99°. P. 96. Plasma chlorides = 546 mgm. Blood urea = 50 mgm.

Before operation he was given intravenous drip saline and 1 c.c. ephedrin intramuscularly. The anaesthetic was 10 c.cs. Percaine intrathecally. A right paramedian incision was made and a large fixed carcinoma of the caecum found. An ileo-transverse colostomy was performed and the abdomen closed. After operation, the continuous drip saline was still used and the patient made an uninterrupted recovery.

CASE 36 was a boy, aged 12, who complained of pain around a previous appendix scar for 3 days. He had been sick for 3 days and bowels had not opened for 3 days.

His general condition was fair only, and his tongue was dry. His abdomen was distended and there was marked tenderness round the appendix scar.
T. 99°. P. 72. Urinary chlorides were absent. Plasma chlorides = 495 mgm. Blood urea = 60 mgm.

Before operation he was given 1 pint of rectal saline and $\frac{1}{100}$ gr. atropin. The anaesthetic was chloroform 2 parts, Ether 3 parts. The scar was excised and adhesions removed with great difficulty. The bowel was viable. The abdomen was closed in layers. After operation, rectal drip salines were used and the boy made an uneventful recovery.

CASE 37 was a man, aged 62, who complained of upper abdominal pain for 1 day. He had been sick at the onset. There had been no bowel action for 3 days.

His general condition was good and his tongue was moist. Examination revealed a tender lump in the epigastrium about the size of a plum. T. 98·6°. P. 76. Plasma chlorides = 594 mgm. Blood urea = 60 mgm.

The anaesthetic used was 1% novocain as a local anaesthetic. An incision was made over the lump and it was found that an omental band had caused a small loop obstruction. The band was severed and the abdomen closed.

After operation he was given rectal salines and he made an uneventful recovery.

CASE 38 was a woman, aged 46, who complained of abdominal pain for 1 day. Pains were more noticeable round an old appendix scar. She had been sick since the onset and bowels had not opened since the previous day.

Her general condition was good and her tongue was moist. Her abdomen was slightly distended and tenderness was present round the the old appendix scar.
T. 98·4°. P. 100. Plasma chloride = 602 mgm. Blood urea = 50 mgm.

Before operation she was given $\frac{1}{75}$ gr. atropin. The anaesthetic consisted of chloroform 2 parts, ether 3 parts. The scar was excised and small intestine was found to be adherent to it. The adhesions were divided and the abdomen was closed. After operation she was given rectal drip salines and she made an uninterrupted recovery.

CASE 39. This patient, a man aged 50, complained of pain around the umbilicus of 1 day's duration. He had been repeatedly sick since the onset. There had been no bowel action since the previous day.

His general condition was very bad. He was suffering from severe shock. Examination of his abdomen showed distension particularly on the left side. Tenderness, rigidity and rebound tenderness were present there. T. 96°. P. 80. Plasma chlorides = 561 mgm. Blood urea = 100 mgm.

Before operation he was given $\frac{1}{75}$ gr. atropin. The anaesthetic was nitrous oxide and oxygen. A left paramedian incision was made. There was free blood-stained fluid in the peritoneal cavity. A loop of pelvic colon was completely gangrenous and strangulated by a large loop of small intestine which was itself forming a volvulus. The volvulus of the small intestine was undone, the bowel being viable. The gangrenous loop of colon was exteriorised.

After operation, intravenous drip salines were instituted and radiant heat was applied to the abdomen. On the 2nd day, a Paul's tube was inserted into the upper pink portion of the exteriorised loop. On the 3rd day, the gangrenous loop was removed and a second Paul's tube inserted into the lower pink end. On the 26th day, an end to end anastomosis was performed. Thereafter convalescence was uneventful.

CASE 40 was a man, aged 54, who complained of pain in the lower abdomen for 2 days. It centred round an old gastro-jejunostomy scar. He had been sick frequently for 2 days

and there had been no bowel action for 1 day.

His general condition was good, but his tongue was dry. There was slight distension of the abdomen and there was tenderness around the old scar. T. 98°. P. 86. Plasma chlorides = 561 mgm. Blood urea = 90 mgm.

Before operation he was given $\frac{1}{75}$ gr. atropin and the anaesthetic was chloroform 2 parts, Ether 3 parts. The scar was excised and small bowel was found to be adherent to it. The adhesions were divided and the abdomen was closed in layers. After operation he was given rectal drip salines and his convalescence was uneventful.

CASE 41 was a man, aged 55, who complained of increased swelling and pain in a previously existing reducible left inguinal hernia. It was not now reducible. He had been sick at the onset and there had been no bowel action since the previous day.

His general condition was good and his tongue was moist. Examination revealed a large irreducible and tender left inguinal hernia. T. 98°. P. 86. Plasma chlorides = 602 mgm. Blood urea = 60 mgm.

Before operation he was given 1 c.c. ephedrin intramuscularly. The anaesthetic was 10 c.cs. Percaine intrathecally. At operation a loop of sigmoid colon was found strangulated, but viable. The bowel was returned to the abdomen and a repair of the hernia made. After operation he was given rectal drip salines and he made an uninterrupted recovery.

CASE 42 was a man, aged 37, who complained of a lump and pain in the left inguinal region for 30 hours. He had been sick at the onset and his bowels had not acted for 24 hours.

His general condition was good. His tongue was moist. Examination revealed a tender irreducible left inguinal hernia. T. 97°. P. 42. Plasma chlorides = 569 mgm. Blood urea = 60 mgm.

The anaesthetic used was 1% novocain as a local anaesthetic. At operation it was found that a loop of small intestine was strangulated, but viable. The bowel was returned to the abdomen and the hernia repaired. The patient made an uneventful recovery.

CASE 43. This patient, a man aged 84, complained of pain and increasing swelling in a previously existing left inguinal hernia for 2 days. He had vomited on the previous day and his bowels had not acted for 1 day.

His general condition was fair, but his tongue was dry. Examination revealed a large irreducible left inguinal hernia. T. 97·4°. P. 90. Plasma chlorides = 544 mgm. Blood urea = 140 mgm.

The anaesthetic was 1% novocain used locally. At operation it was found that a loop of small intestine was strangulated, but viable. The bowel was returned to the abdomen and the hernia repaired. The patient made an uneventful recovery.

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SECTION IX.

SUMMARY.

1. A series of 361 cases of acute intestinal obstruction admitted to Croydon General Hospital during the years 1931 - 6 and to the Royal Sussex County Hospital, Brighton, during the years 1932 - 6, were examined to find possible flaws in diagnosis and treatment. There was very little difference in the yearly death rate.
2. A second series of 43 cases, admitted to the Royal Sussex County Hospital, Brighton, during the year 1938, was examined with greater care and an attempt was made to eliminate errors in treatment.
3. The death rate in the 1st series was 31·02%.
   The death rate in the 2nd series was 13·95%.
4. No new operation was devised and no new drug treatment was used, yet the death rate was decreased considerably.
5. The decrease in the death rate is attributed to:-
   (a) More accurate diagnosis.
   (b) The use of plain X-ray.
   (c) Greater consideration to the patient's pre-operative condition, particularly to
      1. Dehydration.
      2. Increased blood urea.
      3. Chloride deficiency.
   (d) The improvement in the patient's condition before operation.

(e) Better attention to the choice of the anaesthetic.

(f) Less operative interference.

(g) Exteriorisation of the bowel rather than resection and anastomosis.

(h) The more frequent use of intravenous and rectal drip salines.

(i) The use of radiant heat after operations.

(j) As a result of the above, the great fall in post-operative complications.

(k) This tends to support the Experiments of Van Beuren (69) that no specific obstruction poison exists, and that it is the deprivation of valuable food, water and salts which does most harm. (70).

6. Theoretically, the death rate could be lowered still further. Of the 6 deaths in the 2nd series,

2 died on the operating table due to bad choice of anaesthetics. (Cases 30 and 34). This might have been avoided.

2 died from bad operative procedures. (Cases 8 and 18). In one (Case 8) more was done than was necessary to save the life of the patient. In the other (Case 18) faulty technique was used, namely, the use of a small rubber tube as drainage for a caecostomy.

2 died from myocardial degeneration (Cases 7 and 19). It is conceivable that one at least of them (Case 7)

might have been saved.

7. Much blame has been attached to the general practitioner for not diagnosing the cases earlier. This is not strictly true. The average time before a case of obstruction of the small intestine is admitted to hospital is 1·2 days. On the other hand, obstruction of the colon, which is nearly always carcinomatous and comes on insiduously, is in evidence for 6 days before surgical interference is performed, but only 8 cases out of the series of 43 were of this type.

8. The most constant signs of acute intestinal obstruction are pain and sickness. The former is associated with borborygmi which reach their height at the maximum of the pain and can be timed with the stethoscope.

9. If there is any doubt, the easiest method to confirm the diagnosis without causing much discomfort to the patient is the plain X-ray photograph of the abdomen.

10. A radiograph will always tell whether there is an obstruction of the small intestine but not its actual site, but it will not only confirm the diagnosis of obstruction of the large bowel but also its actual site.

11. Before operation, greater attention must be paid to:-

    (a) Dehydration.

    (b) High blood urea.

    (c) Lowered blood chloride.

    (d) Lowered blood pressure.

(e) The possibility of lowering the blood pressure still further by spinal anaesthesia.

(f) Shock.

12. During operation, the surgeon should not:-

(a) Make more incisions than it necessary.

(b) Make any anastomosis if it can be avoided.

(c) Resect bowel but rather exteriorise the gangrenous loop.

(d) Do more than is necessary to save the patient's life. The surgeon's duty is to prolong life, not to shorten it.

13. After operation, attention must be paid to:-

(a) Shock.

(b) All pathological chemical conditions previously mentioned.

(c) Free use of morphia to rest the patient and allow restoration of bowel function.

(d) The use of the flatus tube.

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SECTION X.

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